The New England
Journal of Medicine

Copyright, 1940, by the Massachusetts Medical Society

VOLUME 222 JUNE 27, 1940 NUMBER 26

THE EFFECT OF SULFANILAMIDE ON THE LENGTH OF LIFE OF PATIENTS WITH SUBACUTE BACTERIAL ENDOCARDITIS*

HUGH H. STEELE, M.D.†

DEADWOOD, SOUTH DAKOTA

A REVIEW of the literature concerning subacute bacterial endocarditis shows that much is yet to be learned about the etiology of this relatively common disease. Reimann[1] believes that it has been impossible to prove that the streptococcus is anything more than a secondary invader, although the work of Rosenow,[2] in producing the disease by intravenous injection of certain strains of *Streptococcus viridans* without previous injury to the heart valves, appears to demonstrate that this organism is the primary invader in the disease. Evidence has been presented by Feldman and Trace,[3] among others, that the disease is closely related to infection in the mouth, throat and nose. Experiments tending to prove that foci of infection in the oropharynx may be the cause of endocarditis have been performed by Welch and his co-workers,[4] but others, among them Kinsella and Muether,[5] have been unable to do this, although the two latter produced an endocarditis by the intravenous injection of *Streptococcus viridans* into dogs whose heart valves had previously been injured. They believe that the condition produced in dogs, which is apparently identical pathologically with subacute bacterial endocarditis in the human subject, is dissimilar from it because of the fundamental difference between the traumatized valve of the dog and the diseased valve of the human being, and they plan a study to compare the two more closely. In general, all recent experimental work is encouraging in tone, as Graybiel[6] has stated. Nevertheless, much more must be done in order to determine the factors leading to the invasion of the blood stream, the attack on the endocardium and the failure in human beings of methods of treatment successful in experimental animals.

The treatment of subacute bacterial endocarditis, as with any disease whose etiology and pathogenesis are not understood, has been carried out to a great extent on a trial-and-error basis. As new methods of combating other forms of infection have been discovered, they have been applied to the treatment of endocarditis. As each has been tried, occasional reports of cures have been published; then, as further work has been done, the new method has been shown to be of little value and other ideas have been put to test. It is probable that the cures credited to these methods occurred in cases of so-called benign endocarditis.[7]

With the discovery of sulfanilamide and the reports of excellent results with its use in hemolytic streptococcus infections, it was at once hoped that the drug would be equally effective in the treatment of conditions in which *Streptococcus viridans* was involved. Early reports, indeed, indicated that excellent results might be obtained through its use in the treatment of subacute bacterial endocarditis. One case of recovery was reported.[8] But with the reports as to its beneficial effects came others dealing with its adverse effects. These are well set forth in the monograph of Long and Bliss,[9] who also note that cerebral toxic effects such as headache, anorexia, nausea, vomiting and dizziness, cyanosis, simple fever, dermatitis, acidosis, renal damage (the occurrence of which they question), jaundice without anemia, mild hemolytic anemia, acute hemolytic anemia, agranulocytic angina and leukemoid reactions may be observed as a result of sulfanilamide therapy. The neutropenic states resulting from the use of the drug are by far the most serious reactions covered, and reports of these have been many.[10]

In the past nine years, 76 proved cases of subacute bacterial endocarditis have been seen at the University of Chicago Clinics. The diagnosis was

*From the Department of Medicine, University of Chicago Clinics.

†Formerly assistant physician in medicine, University of Chicago Clinics.

based on certain criteria: the presence of active endocarditis, fever, positive blood culture and embolic phenomena.[11] Of these cases, 18 were treated with sulfanilamide. In studying the effects of this drug on the course of subacute bacterial endocarditis, 4 cases were excluded* so that, for the sake of uniformity, only cases in which the *Streptococcus viridans* was grown on blood culture might be considered. The 14 remaining cases were studied in order to determine the effect of the drug on bacteremia, fever and time of survival. At the same time an attempt was made to note the presence of changes in the blood-cell counts, of dermatitis and of other ill effects.

Effect on Bacteremia

In 5 of the 14 cases there was a definite drop in colony count on blood culture. In the majority of cases four plates, each with 1 cc. of blood, were poured, and the colonies counted and averaged. An example of this fall in count is found in the following case.

R. S. (No. 183396), a 17-year-old girl, entered the Albert Merritt Billings Hospital September 11, 1937, on the service of Dr. Allan T. Kenyon. She was born a blue baby and lived against the expectation of the physician who delivered her. About 2 years prior to admission she had had an episode of swollen and painful knee and ankle joints and spent 5 weeks in bed. The onset of the present illness apparently occurred in April, 1937, when an acute upper-respiratory infection was followed by pain in the lower chest posteriorly, not associated with respiration. There was a weight loss of 35 pounds in the next 4 months. Since April, 1937, there had been several attacks of epistaxis. Profuse night sweats had been present for 1 month.

On examination the patient was seen to be acutely ill. The heart was enlarged to the left. There was a thrill at the base and a loud diastolic and soft systolic murmur over this area. At the apex was a blowing systolic murmur immediately following a markedly accentuated second sound. A water-hammer pulse was present. The red-cell count was 3,300,000, the hemoglobin 70 per cent and the white-cell count 10,400. A blood culture showed 117 colonies of *Streptococcus viridans* per cubic centimeter of blood. Subsequent cultures showed 280 colonies on September 13, 129 on September 15 and 274 on September 17. On September 19, 4.4 gm. (66 gr.) of Prontylin was given, the dose being increased the next day to 4.8 gm. (72 gr.) daily. By September 24 the colony count had fallen to 63 per cubic centimeter of blood and on September 28 to 39. On the latter day the Prontylin was stopped and the following note was made by the intern: "No noticeable temperature change during Prontylin administration. . . . Hemoglobin remained about the same while Prontylin was being given." On October 5 the colonies numbered 32. On October 6 the patient developed nausea, vomiting and diarrhea; in spite of a blood transfusion and other supportive measures she died on October 15. Permission for an autopsy was refused.

*In three of these, diphtheroids were grown in the blood cultures, and in the fourth a gram-negative rod.

A tabulation of the colony counts in 11 of the patients studied (Table 1) shows a definite fall in count in 5 cases, a questionable change in 4 and a rise, in spite of sulfanilamide therapy, in 2.

Table 1. *Effect of Sulfanilamide Therapy on Colony Count.*

Hospital No.	Colony Count: Before Therapy	First Week	Second Week	Third Week and After
1567	104–261	36–12	19–6	28–74
172452	2000 (estimated)	1000 (estimated)		
183396	117–280	63	39	32
193400	7–38	2–3	5	4
196449*	14–29	2	5	8
200187	129–133	5	4	2
171437	252–68	88–36	79	
195967	9–3	8		
219952	40		40	20
174595†	178–700	754	Innumerable	Innumerable
210329	45–89	90–117		

*Sulfanilamide was stopped for a short time after the second week; the count rose to 32, but fell to 8 when sulfanilamide was resumed.

†The average dose of sulfanilamide in all but this case was 3 to 4 gm. (45 to 60 gr.) daily; this patient received 6 gm. (90 gr.) daily.

Effect on Fever

In the majority of patients with subacute bacterial endocarditis there is fluctuation in the height of the fever curve; it was therefore difficult to determine definitely whether the administration of sulfanilamide had any effect on the temperature. In 1 case (Case 9), which is reported more fully below, a definite fall in the average level of the afternoon spike occurred two days after the drug had been started; the height of the spike was maintained at a nearly normal level for five days; for the next two months it was lower than it had been before sulfanilamide therapy had been started.

Toxic Effects

Changes in White-Cell Count

In the majority of cases the white-cell count ran between 9000 and 14,000, with an increase in the percentage of polymorphonuclear cells. In several cases the count fell to 600 during the course of sulfanilamide administration, but in all cases it rose immediately without specific treatment. The fall was probably unrelated to sulfanilamide therapy, since this was also observed in cases not receiving the drug.

Changes in Red-Cell Count

There were no cases of acute hemolytic anemia in this series. There was, however, in most cases, a fall in the red-cell count, which probably occurred as a result of the disease process rather than because of sulfanilamide therapy. In only 1 case was there a fall in the count that could be said to have

occurred immediately following the start of sulfanilamide therapy. The report follows.

R. F. (No. 200187), a 26-year-old woman, was admitted on June 17, 1938, on the service of Dr. C. Phillip Miller. She had had rheumatic fever at the age of 14. Following this illness she remained well until October, 1937, when a tonsillectomy was performed. She bled severely following the operation and required four transfusions. Since the tonsillectomy she had been in bed, becoming progressively weaker, with the body weight decreasing from 150 to 92 pounds. During the first part of the illness she had pain under the costovertebral angles and considerable vomiting, both of which had continued to the time of admission. In January, 1938, she began to notice severe palpitation of the heart and joint pains in all extremities. Two weeks prior to admission her family physician had told her that she had an infection of the blood stream.

On physical examination at admission the patient was very weak and pale. The heart rate was 120; the heart was not enlarged; there was a thrill at the cardiac apex, with systolic and diastolic murmurs over this area. The second pulmonic sound was accentuated; over the aortic area could be heard a systolic murmur with a snapping second sound. The liver was felt 2 cm. below the right costal margin. The spleen was not definitely felt, but there was resistance on inspiration in the left upper quadrant of the abdomen. There was slight clubbing of the fingers. The red-cell count was 3,100,000 and the white-cell count 10,350. On June 18 a blood culture showed 129 colonies of *Streptococcus viridans* per cubic centimeter of blood. On June 19 sulfanilamide was started in doses ranging from 3.6 to 5.4 gm. (55 to 80 gr.) per day. The colony count on this day was 133. On June 20 the red-cell count was 4,200,000, the hemoglobin 54 per cent and the white-cell count 13,560. By June 24 the red-cell count had fallen to 2,800,000 and the hemoglobin to 42 per cent; the white-cell count had risen to 20,000. Meantime the colony count had dropped to 5 per cubic centimeter of blood, and on June 29 it fell to 4. On June 26 the patient was given a transfusion of 500 cc. of blood. The red-cell count ranged between 2,800,000 and 3,040,000 until July 2, when the drug was stopped because the patient complained of a severe headache. The headache was gone by July 4, and sulfanilamide was resumed. It was stopped on July 6 because of intense dizziness, and resumed on July 15. On August 2, however, the drug was again stopped because of the appearance of papilledema, without other eye signs or symptoms. On July 21 a fall in temperature from 102 to 100°F. was noted, and the latter level persisted until August 11. On July 29 a blood culture grew an average of 2 colonies per cubic centimeter of blood. On August 6 the patient felt better. The red-cell count ranged from 3,140,000 on July 17 to 2,460,000 on August 4 and 3,950,000 on August 14. On August 11 sulfanilamide was again started; on August 12 the patient began to have nausea after each dose. She developed a left hemiplegia and facial paralysis on August 14, gradually failed, and died on August 23.

The autopsy findings included subacute bacterial endocarditis affecting the mitral value and wall of the left atrium, antecedent chronic rheumatic mitral valvulitis and left atrial endocarditis, moderate mitral stenosis and rheumatic aortic endocarditis, minimal and healed.

Comment. In addition to the mild hemolytic anemia noted between June 20 and June 24, the severe headache, nausea and papilledema were all believed to have resulted from the toxic action of sulfanilamide.

Dermatitis

One patient developed a dermatitis which was thought to have resulted from sensitization of the skin to sunlight by sulfanilamide. The report follows.

C. E. (No. 219952), a 28-year-old man, was admitted May 7, 1939, on the service of Dr. George F. Dick. He complained of weakness, fatigue and fever of 8 months' duration and sore fingers of 3 months' duration. For the last 3 months he had developed ankle swelling and tiny red areas on his feet and ankles after standing for 15 to 30 minutes. He had had rheumatic fever each winter from the age of 12 to that of 18. Prior to the time of onset of the present illness he had worked as a railroad clerk, and had felt well.

On physical examination the patient was pale; there were petechiae over the left scapula and over the left tibia in its middle third. The posterior pharynx was red and granular; the tonsils had been removed. Over the lung bases were increased breath sounds, with subcrepitant rales which cleared on coughing. The heart rate was 120; the apex by palpation was 10 cm. to the left of the midline in the fifth intercostal space. There was a systolic thrill at the apex, with a systolic apical murmur referred especially to the left axilla but audible over the entire precordium. The right testis was undescended. There was puffiness but no pitting of the feet and ankles. A tender, red area 1 cm. in diameter was noted on the left index finger. The red-cell count was 3,100,000, and the white-cell count 9000. A blood culture was positive for *Streptococcus viridans,* with 40 colonies per cubic centimeter. On May 13 the administration of sulfanilamide was begun. The oral temperature up to this time had been rising daily to around 102°F. at 4 p.m. By May 15 the curve had flattened, and until May 20 the rectal temperature did not rise above 99°F. From May 20 to July 20 it reached a daily peak of 102°F. On May 21, because of a rise in the pulse to over 140, the patient was digitalized and received from 0.1 to 0.3 gm. (1 to 3 cat units) of digitalis daily thereafter. On May 29 the colony count was 40 per cubic centimeter of blood, and on June 9, 20.

On May 31, after 18 days of sulfanilamide therapy, the patient developed a macular erythematous rash, blanching on pressure, over the left side of the body. This was thought to be a dermatitis medicamentosa, and members of the Dermatology Service concurred in this diagnosis. At the time of appearance of the rash the patient had been receiving 3.6 gm. (54 gr.) of sulfanilamide daily, which had kept the blood level at about 13.3 mg. per 100 cc., 0.6 gm. (10 gr.) of ferrous sulfate daily, 0.2 to 0.3 gm. (2 to 3 cat units) of digitalis daily, 0.010 gm. (⅙ gr.) of morphine sulfate four times a day, and nasal oxygen. The patient's bed was so situated that the sun shone on the left side of his body from 1 p.m. until evening each day, and it was the opinion of the attending physician and members of the Dermatology Service that sulfanilamide sensitization to sunlight was the most probable etiologic factor.

On July 20 the patient began to have hiccoughs, a rise in rectal temperature to 102.6°F., increased rales in both lung bases and a rise in pulse to 140. In spite of blood transfusions and general treatment, he died on July 29.

The autopsy findings included subacute bacterial endocarditis, embolization of small vessels throughout the body, mesenteric embolus with peritonitis, and early bronchopneumonia.

Effect on Time of Survival

Of the 76 cases of subacute bacterial endocarditis which have been seen at the University of Chicago Clinics since 1930, it was possible to determine the date of death in 40. In 10 of these the patients had received sulfanilamide. All had been found to have a bacteremia caused by *Streptococcus viridans*. The date of onset was not easily determined. In many cases it was based on a history of influenza or similar acute upper-respiratory infection in a previously symptomless individual, followed by chills, fever, cardiac signs, weight loss, weakness and embolic phenomena. Occasionally it was calculated from the date of surgical procedures which were followed by the symptoms just noted. Table 2 summarizes the cases studied.

The 10 patients who received sulfanilamide, averaging about 3 gm. (45 gr.) daily, lived from one to eleven months after onset. The average time of survival was 5.6 months. Three patients lived longer than seven months; none lived longer than eleven months. In the group of 30 patients treated without sulfanilamide, the time of survival ranged from two to seventeen months, the average being 5.6 months. Five patients lived longer than seven months and 3 longer than eleven months.

Certainly, on the basis of these statistics, no effect on the prolongation of life by sulfanilamide can be observed. The average length of life after onset in each of the two groups was the same, while the fact that 3 untreated patients lived longer than eleven months, and that none of those treated did so, might be interpreted as indicating that sulfanilamide actually shortened the time of survival.

Table 2. *Summary of All Cases of Subacute Bacterial Endocarditis Patients Studied.*

Case No.	Hospital No.	Sex	Age	Date of Onset	Date of Admission	Date of Discharge	Date of Death	Duration of Life After Onset	History of Rheumatic Fever or of Other Diseases of Significance	Autopsy
			yr.					mo.		
					Patients Receiving No Sulfanilamide					
1	1637	F	21	3/—/30	9/11/30		9/24/30	6	Signs of cardiac insufficiency in childhood. At autopsy, mitral regurgitation and stenosis; partial patent foramen ovale.	Yes
2	12898	M	22	12/—/31	3/11/32	3/18/32	6/ 9/32	5	Rheumatic fever at 11	No
3	17704	F	31	7/—/32	1/21/33		2/11/33	7	Series of acute childhood diseases at 1	Yes
4	21168	F	19	1/—/30	3/28/30	4/10/30	5/20/30	4	Growing-pains as child	No
5	22288	M	43	2/—/30	4/20/30		6/28/30	4	Rheumatic fever in childhood	Yes
6	26592	F	24	6/—/33	9/24/33	10/14/33	10/27/33	4	Rheumatic fever at 10	No
7	31829	M	39	6/—/30	12/26/30		1/27/31	7	Rheumatic fever at 21	Yes
8	39772	M	39	4/—/31	6/ 4/31	6/13/31	10/—/31	6	Rheumatic fever at 11	No
9	50419	M	28	3/—/32	5/10/32		6/23/32	3	Splenic anemia; rheumatic fever at 12.	No
10	55151	M	32	1/—/32	4/29/32		5/ 7/32	4	Syphilis	Yes
11	62926	M	72	6/—/32	7/12/32	7/13/32	1/—/33	7	None	No
12	70076	F	23	7/—/32	10/19/32		11/ 6/32	3	None	No
13	71401	M	58	8/—/32	11/10/32		12/15/32	4	Rheumatic fever at 10; infectious arthritis.	No
14	74338	F	26	4/—/32	1/20/33	3/ 4/33	4/10/33	12	Rheumatic fever at 15	No
15	75304	M	51	11/—/32	1/17/33		2/ 9/33	3	Rheumatic fever at 20	Yes
16	76680	F	18	11/—/32	3/17/33		3/18/33	4	Congenital heart disease	Yes
17	80299	M	28	6/—/35	8/19/35		2/25/36	8	None	No
18	84445	F	23	4/—/33	6/17/33		9/19/33	5	Rheumatic fever at 5	No
19	88139	F	24	6/—/33	8/11/33		10/20/33	4	None	No
20	93842	M	49	11/—/32	9/14/34		9/26/34	14	Rheumatic fever at 14	No
21	106885	F	41	4/—/34	6/27/34	7/11/34	8/ 8/34	4	Rheumatic fever at 14	No
22	106957	F	23	2/—/34	6/28/34		6/28/34	4	None	No
23	108913	M	72	7/—/34	7/27/34		9/20/34	2	None	Yes
24	118500	M	49	12/—/33	4/22/35		5/28/35	17	None	Yes
25	123326	M	33	6/—/34	3/ 5/35		3/15/35	9	Rheumatic fever at 30	Yes
26	131932	F	33	3/—/35	7/10/35		7/11/35	4	Rheumatic fever at 12	Yes
27	142234	F	23	5/—/35	1/ 7/35		4/19/35	11	None	Yes
28	143582	M	61	10/—/35	1/ 8/36	1/28/36	3/12/36	5	None	No
29	150750	M	42	3/—/36	5/ 4/36		5/ 9/36	2	Syphilis	No
30	211961	M	54	11/—/38	1/ 5/39	1/16/39	1/21/39	2	None	No
					Patients Treated with Sulfanilamide					
1	1567	M	34	9/—/36	2/ 9/37		7/12/37	5	Rheumatic fever in childhood	No
2	171437	F	15	10/—/36	3/17/36	3/31/37	4/18/37	6	Rheumatic fever from 10 to 14	No
3	172452	F	25	11/—/36	3/31/37		4/12/37	5	None	Yes
4	174595	F	33	12/—/36	5/ 4/37		5/17/37	5	None	Yes
5	183396	F	17	7/—/37	9/11/37		10/15/37	3	Congenital heart disease (?); rheumatic fever at 14.	No
6	187310	M	56	12/—/37	1/ 5/38		1/16/38	1	Rheumatic fever from 18 to 19	Yes
7	195967	M	16	9/—/37	4/ 5/38	4/22/38	8/—/38	11	Severe pneumonia at 5	No
8	196449	M	43	12/—/37	4/22/38	5/11/38	6/11/38	6	None	No
9	199591	M	49	5/—/38	6/ 3/38		9/18/38	4	Rheumatic fever at 10	Yes
10	200187	F	26	10/—/37	6/17/38		8/23/38	10	Rheumatic fever at 14	Yes

Summary

Sulfanilamide therapy had no effect on the general course of 13 cases of subacute bacterial endocarditis.

The main beneficial effect was a fall in the number of bacteria in the blood stream.

In one case there was a definite drop in the temperature curve coincident with the use of sulfanilamide; in other cases it was thought possible that lowering of the level was related to use of the drug.

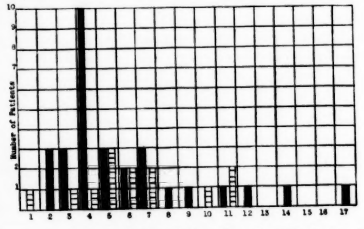

FIGURE 1. *Length of Life (After Onset) of Patients with Subacute Bacterial Endocarditis.*

The cross-hatched blocks represent patients who received sulfanilamide, the solid blocks those who did not.

In general no severe toxic effects were noted. At least one case of hemolytic anemia was noted. There was one case of dermatitis believed due to sensitization of the skin to sunlight by sulfanilamide. Nausea, headache and papilledema were also noted, and were believed to have been caused by the drug.

Sulfanilamide did not prolong the life of patients in this series, and there is some evidence that it may have actually shortened the time of survival.

REFERENCES

1. Reimann, H. A.: Infectious diseases. *Arch. Int. Med.* **64**:362-405, 1939.
2. Rosenow, E. C.: Experimental infectious endocarditis. *J. Infectious Dis.* **11**:210-224, 1912.
3. Feldman, L., and Trace, I. M.: Subacute bacterial endocarditis following the removal of teeth or tonsils. *Ann. Int. Med.* **11**:2124-2132, 1936.
4. Welch, H.; Murdock, T. P., and Ferguson, J. A.: Subacute bacterial endocarditis produced in rabbits with streptococci that resemble diphtheroids. *J. Lab. & Clin. Med.* **21**:1264-1273, 1936.
5. Kinsella, R. A., and Muether, R. O.: Experimental streptococcic endocarditis. *Arch. Int. Med.* **62**:247-270, 1938.
6. Graybiel, A.: Diseases of the heart: review of significant contributions made during 1938. *Arch. Int. Med.* **63**:980-1012, 1939.
7. Oille, J. A.; Graham, D., and Detweiler, H. K.: A further report on a series of recovered cases of subacute bacterial endocarditis. *Tr. A. Am. Phys.* **39**:227-230, 1924.
   Libman, E.: The prognosis in subacute bacterial endocarditis. *Tr. A. Am. Phys.* **40**:351-361, 1925.
   Idem: A further report on recovery and recurrence in subacute bacterial endocarditis. *Tr. A. Am. Phys.* **48**:44-54, 1933.
8. Major, R. H., and Leger, L. H.: Recovery from subacute infectious endocarditis following prontosil therapy. *J. A. M. A.* **111**:1919, 1938.
9. Long, P. H., and Bliss, E. A.: *The Clinical and Experimental Use of Sulfanilamide, Sulfapyridine, and Allied Compounds.* 319 pp. New York: The Macmillan Company, 1939.
10. Bethell, F. H.; Isaacs, R.; Goldhamer, S. M., and Sturgis, C. C.: Blood: review of recent literature. *Arch. Int. Med.* **61**:923-1011, 1938.
    Allen, J. G., and Short, C. L.: Granulocytopenia associated with sulfanilamide therapy. *New Eng. J. Med.* **219**:6-8, 1938.
    Kracke, R. R.: Relation of drug therapy to neutropenic states. *J. A. M. A.* **111**:1255-1259, 1938.
    Fitz-Hugh, T., Jr.: Sensitivity reactions of the blood and bone marrow to certain drugs. *J. A. M. A.* **111**:1643-1647, 1938.
11. Editorial: The prognosis in subacute bacterial endocarditis. *J. A. M. A.* **113**:1328, 1939.

SODIUM MORRHUATE IN THE TREATMENT OF EPICONDYLITIS OF THE HUMERUS

A Report of Five Cases

FRANK A. SLOWICK, M.D.*

PITTSFIELD, MASSACHUSETTS

RECENT unsatisfactory results in the treatment of epicondylitis of the humerus, or radiohumeral bursitis, by conservative methods, have led to a search for a simple nonsurgical method which would give greater promise of relief and cure. Experience with conservative treatment by physiotherapeutic and other means has resulted only in the discouragement of physician and patient. In 1937, while considering the efficacy of sodium morrhuate obliteration of prepatellar bursas, I decided to use the drug in a case of epicondylitis which was very resistant to the usual physiotherapeutic methods. The successful cure of this case after two injections of sodium morrhuate, and the complete freedom from all symptoms in two months, led to the further application of the method.

A search of the literature on this subject reveals that there are many divergent opinions regarding pathology and treatment. The review of North[1] is all that can be desired for an understanding of the various phases of the subject. Of interest is Cyriax's[2] view that "injections by alcohol, carbolic acid and novocain are uncertain, are of small significance and have little effect on the course of disability." He is of the same opinion regarding rest, x-ray therapy, diathermy, ionization and removal of foci of infection.

While only passing mention is made of novocain infiltration in the American literature, the French have taken this method of treating the

*Consulting orthopedic surgeon, House of Mercy Hospital, Pittsfield; orthopedic surgeon, St. Luke's Hospital, Pittsfield.

condition more seriously. Massart[3] in 1935 reported the cure of three tennis players by the injection of novocain into the painful region. He endorsed the method for its satisfactory results, and credited Leriche with its application in this condition. Leriche[4] confirmed the efficacy of the method and stated that he tried it first in 1928 and obtained a cure with two injections. Tavernier[5] questioned these results and stated that in his hands the method was not so regularly efficacious as Massart believed. It is my own opinion that the infiltration method has been passed over too lightly. Its very simplicity has taken away from the method the serious consideration it deserves.

The first three cases reported here are from my own experience. The last two cases are from the records of my brother, Dr. Joseph E. Slowick, of Palmer, Massachusetts, who was induced to try the method on my recommendation.

Case Reports

Case 1. W. D. G., a 38-year-old automobile service-station manager, was first seen on May 22, 1937. He complained of pain on the outer surface of the left elbow on movement. He stated that 4 days previously, while changing a tire, he had turned and struck the handle of the jack with his left elbow on the bony prominence of the outer surface. From that time he complained of pain on motion of the hand. The arm tired easily, and at rest there was a feeling of numbness. He had never had trouble with the elbow before.

Physical examination showed a young man of rugged physique. The examination was not remarkable. The teeth were negative on gross examination. The tonsils had been removed. The left elbow, as compared with the right, showed a slight fullness just distal to the epicondyle, which was tender on pressure in an area about 0.9 cm. in diameter. Grasping and flexion and extension movements of the hand caused pain at the injured area. There was no discoloration. X-ray examination of the elbow on May 22 showed no bony changes.

A diagnosis of epicondylitis was made and treatment by diathermy and massage was started, and was continued until July 3, three times weekly. There was no improvement at the end of that time. This treatment was discontinued and 0.5 cc. of 1 per cent novocain was injected into the site under the tendon of the extensor group. There was immediate relief by this procedure, with recurrence the next day.

Five days later a second injection of novocain was made, with the same result. On July 13 the skin and subjacent tissues were injected with a small amount of novocain, and 0.3 cc. of 5 per cent sodium morrhuate was injected into the area under the extensor tendon. On July 16 the patient reported that in the interim there was an exaggeration of symptoms, but on that day the flare-up had subsided. At subsequent visits on July 19 and 25 and August 3 there was a definite diminution of the pain on movement of the wrist and hand. A second injection of 5 per cent sodium morrhuate was made on August 4.

On August 20 the patient reported that a slight flare-up had again occurred, which lasted 3 days. Following this there was a rapid disappearance of the pain. On September 2 he was completely well. Following the first injection of sodium morrhuate there was an increase in the swelling at the site, and there was a slight fluctuation in that area which continued until the last visit on September 2.

On June 14, 1939, the patient reported that he had been entirely well since the visit of September, 1937. An x-ray examination at this time revealed no bony changes at the site of the external epicondyle.

Case 2. A. M., a 41-year-old woman, was seen on October 15, 1938. She was employed as an imprinter, operating a machine which required her to move the hands and arms from side to side, and toward the midline of the body. She had been doing this work for several years. Three months before this examination she began to complain of pain over the external aspect of the right elbow. The joint seemed stiff and painful on using the arm and hand in her work. With a rest over a week end the condition improved, but when she resumed her work the soreness at the elbow returned. Six years previously the patient had been in an automobile accident and sustained a severe bruise over the external condyle of the right humerus in the region of the present painful area. She had always felt a sensitiveness in that region, but never the present soreness and stiffness. Her appendix was removed 5 months previous to examination. She had had scarlet fever seven years previously.

Physical examination was not remarkable. The right elbow showed a slight fullness just distal to the external epicondyle, which was tender on pressure. Pronation of the forearm and flexion of the wrist with the elbow extended caused pain. Dorsiflexion of the wrist also caused pain in that region. Passive extension of the elbow was complete, but a definite spring was felt when full extension was approached. There was no other tenderness about the elbow. X-ray examination of the elbow on October 15, 1938, showed no alterations of the bony structures and no unusual soft-tissue shadows.

A diagnosis of epicondylitis of the right humerus was made, and treatment with sodium morrhuate was offered and accepted. The first injection was given on October 18, 1938. First, 0.5 cc. of 1 per cent novocain was injected into the tissues beneath the extensor tendon. Then 0.3 cc. of 5 per cent sodium morrhuate was injected beneath the tendon at the attachment. The pain was temporarily aggravated beginning the next day, but subsided in the next 2 days to a dull ache. On October 22 there was found at the site an area of tenderness, with fluctuation over the tendon of the extensor group just distal to the epicondyle.

The patient had been advised to change her work for a short period, and obtained a transfer to clerical work. She was able to continue this throughout the course of her treatment.

On October 25 the treatment was repeated. On November 5 the patient reported that the condition was again aggravated by the sodium morrhuate, but that within 2 days it had subsided markedly. Thereafter there remained only a dull ache. On November 22 she was again examined. There was no complaint on this visit, and the ache had disappeared. There was still a sense of fullness and fluctuation over the epicondyle and attached tendon.

On December 17, the patient reappeared for a checkup and reported that she was well. There was no tenderness, although there was slight fullness in the region of the extensor tendon. On July 19, 1939, she reported that she

had been completely well since the visit of December, 1938. She had resumed her usual work.

CASE 3. L. S. C., a 35-year-old woman, was first seen on July 11, 1939. She complained of pain in the right elbow. She stated that 2 months before, while playing with her son, she struck her right elbow; thereafter there developed a painful condition at the site of the injury, and while she was able to drive a car and do housework, it had continually troubled her. She was unable to grasp, pull threads or shake down a thermometer. She obtained temporary relief by hot soaks. Fully extending the elbow aggravated the pain. She had been well previous to the onset of this condition.

At physical examination the right elbow showed a tender area over the external epicondyle, and there was pain on pronating the forearm and flexing the wrist. Extension of the elbow produced a slight spasm when the extreme of the movement was approached, and on such motion the patient complained of pain at the external epicondyle of the humerus. A diagnosis of radiohumeral bursitis was made, and the injection treatment was offered and finally accepted.

The first treatment was given on July 24, when a small amount of 1 per cent novocain was injected, followed by 0.3 cc. of 5 per cent sodium morrhuate. On the next day the patient reported that there was a marked increase of pain on moving the hand and wrist. She was unable to fully extend the elbow because of pain. There was slight redness and swelling above the site of the injection. On July 27 she reported improvement, but the elbow still felt sore. On August 5 there was no pain whatever. There remained only a slight stiffness in the movement of flexion. The range of motion was normal. There was still present an area of fluctuation distal to the epicondyle, but there was no tenderness. On that day a second injection of 0.3 cc. was made, following a small amount of 1 per cent novocain. On August 12, the patient stated that she had had no pain, but that there was a mild reaction on the day following the injection. Early each morning she noted a dull ache at the epicondylar area. All movements of the elbow and forearm were normal and painless. Examination showed a slight amount of fluctuation still present at the site of injury. On September 9 she stated that she had had no pain since the previous visit, and there was no tenderness on pressure over the area. The motions were normal. She was discharged.

CASE 4. A. W. J., a 48-year-old man, was seen on November 1, 1938. He complained of pain at the outer aspect of the right elbow. On October 20 he had struck the elbow on a store counter. Pain occurred and increased and there was inability to grip and to supinate forcefully the forearm and hand. Otherwise the patient had been well, and worked long hours as a store proprietor.

Physical examination showed a well-developed and well-nourished man of medium build. There was marked tenderness over the external epicondyle of the right humerus, with pain in that region on forceful extension of the wrist and supination of the forearm and hand. X-ray examination revealed no bony changes in that region, and a diagnosis of radiohumeral bursitis was made.

Treatment by conservative methods, including sedatives, diathermy and massage, three times weekly until November 26, was carried out with only slight relief. Consequently on that day 0.3 cc. of sodium morrhuate was injected into the subtendinous area at the insertion into the external epicondyle. On December 3 the patient reported considerable improvement. He could then grip with the right hand. There was slight tenderness over the extensor attachment. A second injection was made on that date. On December 10 he reported improvement of the grip, but still had discomfort at the extensor site. A third injection of 0.3 cc. of 5 per cent sodium morrhuate was made. On December 17 the patient reported only slight tenderness at the epicondylar area. His grip was good. On December 24 re-examination showed an excellent grip, and only slight tenderness over the epicondyle. There was no pain on movement of the elbow or hand. On June 8, 1939, the patient reported that he had been well since the visit of December 24.

CASE 5. J. F. S., a 44-year-old man, was seen on February 2, 1939. He stated that 4 weeks previously there developed pain in both elbows; the right was quite sore, but the left showed less discomfort. There was no injury or strain that he could recall. He worked as an automobile service-station manager. He had had pneumonia in childhood and influenza in 1918.

Physical examination showed a well-developed and well-nourished man. The temperature was normal. The tongue was slightly coated and the throat was congested. There were large infected stubs of tonsillar tissue in both fossas. The heart and lungs were normal. The elbows showed tenderness on pressure over both extensor tendons at the epicondyles, more marked on the right. There was no swelling. There was pain at the right elbow when attempting to grip.

Following the injection of 0.5 cc. of 1 per cent novocain, 0.3 cc. of 5 per cent sodium morrhuate was injected into the subtendinous area on the right side. On February 10 the patient reported aggravation of the pain and inability to extend the elbow fully for 3 days following injection. At this examination full extension was obtained. There was moderate tenderness in the region of the epicondyle. Another injection of 0.3 cc. of 5 per cent sodium morrhuate was made. On February 17 the patient reported a slight reaction the day after the injection, but for the next 4 days he had been well. Gripping with the right hand caused some pain in the region of the epicondyle. A third dose of sodium morrhuate was administered at this visit. On February 23 the area over the epicondyle was still painful. On March 7 the patient felt well. There was still slight tenderness over the right epicondyle. On March 20 he reported with a severe cold, and remained under treatment for this condition until June 1, 1939. On June 24 he returned and stated that there was only slight tenderness on pressure over the epicondyle.

SUMMARY

There has been presented an injection method of treating epicondylitis of the humerus, or radiohumeral bursitis, using sodium morrhuate as the sclerosing agent. The success of the method in a small number of cases warrants its further application. The number and frequency of treatments required must be determined by the application of the method in a larger number of cases. It is probable that slightly smaller doses may be used, thus minimizing the temporary reaction following each injection. The reaction in each of these cases was not so great as to prevent the patient from continuing his work.

The result in Case 5, while satisfactory, was not

so spectacular as that in the other 4 cases. This would seem to indicate that the truly infectious type of radiohumeral bursitis does not respond so well as does the traumatic or noninfectious type. However, it does not appear to be contraindicated in cases which show foci of infection.

There has been no evidence of subcutaneous-tissue damage with the use of this sclerosing agent. While there is a theoretical possibility of injecting the sodium morrhuate into an extension of the joint capsule in that region, there has been no evidence of that complication following eleven injections in the 5 cases reported. It goes without saying that the solution must be placed accurately and by one who understands the anatomy of the region.

131 North Street

REFERENCES

1. North, J. P.: Tennis elbow: collective review. *Internat. Abstr. Surg.* **67**:175-179, 1938.
2. Cyriax, J. H.: The pathology and treatment of tennis elbow. *J. Bone & Joint Surg.* **18**:921-940, 1936.
3. Massart, R.: L'épicondylite des joueurs de tennis et son traitement. *Presse méd.* **43**:1929, 1935.
4. Leriche, R.: A propos du traitement par infiltration novocaïnique de l'épicondylite des joueurs de tennis, des maladies post-traumatiques de même ordre, des soi-disant apophysites de croissance, de certaines fractures sans déplacement et des séquelles ostéo-articulaires. *Presse méd.* **44**:99, 1936.
5. Tavernier, L.: A propos du traitement de l'épicondylite des joueurs de tennis. *Presse méd.* **44**:99, 1936.

SOME OPPORTUNITIES OF THE MEDICAL PROFESSION*

JAMES B. WOODMAN, M.D.

FRANKLIN, NEW HAMPSHIRE

IT IS a deeply appreciated opportunity to be here tonight because every meeting of this kind is just one more link in the chain of co-operation that we are trying to build up among all the factors of our great medical fraternity. Were I to be granted a single wish in rising to address this assembly, it would be that you, my esteemed associates, would be as impressed today as I have been impressed throughout the past year by the tremendous responsibilities placed upon us. We are servants of humanity and have a humanitarian service to perform which can be best accomplished by organization, co-operation and education.

These meetings serve many excellent purposes. They provide the opportunity for renewal of friendships, for interchange of ideas, for the taking of inventories of those abstract possessions which can be neither bought nor sold. Our task today is to achieve perspective, for we are told, "The young have aspirations that never come to pass; the old have recollections of things that never happened."

Within a little more than three hundred years the land which we call the United States has become the home of the fourth largest national group in the world. China, of course, is first; India, second; and Soviet Russia, third. When the United States was founded, republics were few and weak, and Europe predicted a speedy end of the young nation. For a time the future did seem uncertain, but dangers were overcome until now, in extent, stability, population, wealth and power, our republic ranks either first or among the first of the nations of the earth. May we realize this with humility and send up a prayer for the deliverance of our European brethren from their Gethsemane.

Daniel Webster said, "America has proved that it is practicable to elevate the mass of mankind, — the laboring or lower class, — to raise them to self-respect, to make them competent to act a part in the great right and the great duty of self-government; and she has proved that this may be done by education and the diffusion of knowledge." May we strive to maintain our self-respect and our personal as well as our national independence so that this high ideal may not be destroyed.

Opportunity is a word which, like so many others that are excellent, came from the Romans. It means "near port, close to haven." It is "a favorable occasion, time or place for learning or saying or doing a thing." It is an invitation to seek means for improving our efficiency and our service to our fellows. May we now ask what are some of the opportunities in the medical profession.

In the first place, the medical profession has the opportunity of furnishing an example of good citizenship. A good citizen is a man or woman who is doing something of service to the community. A good citizen is a workman who "needeth not to be ashamed." There is no fitting place in society for the selfish and the greedy, and we shall see in time that only insofar as the range and circle of our duties may include others and help and bless them, shall we find the true joy of living.

*Presidential address delivered at the annual banquet of the New Hampshire Medical Society, Manchester, May 15, 1940.

Secondly, the medical profession has the opportunity of safeguarding the health of the community and the State. The medical profession has done more for the race than has ever before been accomplished by any other body of men, insofar as general welfare is concerned. These gifts to the people have come in the form of vaccination, sanitation, anesthesia, aseptic surgery, bacteriology, therapeutics and many other branches of medicine. For devoted service, for the highest expression of generosity and good will, the physician occupies a place quite incomparable. The story told by Ian Maclaren, in *Beside the Bonnie Brier Bush,* of old Dr. McLeod is not exaggerated or overdrawn. It is a tale that may be duplicated in any community. One must believe concerning men of this type that they are motivated by the highest of impulses, and that they minister under the Master, who never turned away from those who were bruised and broken in body. Like a team of two horses slowly pulling a heavy load out of the mire, the family physician and the specialist are, side by side, slowly but surely liberating the human race from the depths of disease. Their combined value cannot be measured in dollars and cents but rather in years of additional life. Together they constitute a great team.

Thirdly, the medical profession has an opportunity of setting an example of sympathy, charity and kindness. In each generation some of the best minds have devoted themselves to the study of the healing art. This will always be so. There is an allure to the practice of medicine which keeps the conscientious physician struggling on for his patient in the face of any difficulty. I like to believe that it is an inherent love of human kind, which makes life's ultimate goal the universal brotherhood of man.

Finally, the medical profession has the opportunity of an interesting future. With the greater knowledge of the causes of disease which time will bring us, there will be put into the hands of the physician of the future a weapon far more powerful than any we can wield today. We may reasonably look forward to the time when many of the evils which afflict us now will be avoidable, and as a result the span of the life of man, which even in our own time has extended beyond what it was a hundred years ago, will be stretched far beyond the three score and ten that at one time were allotted.

The practice of medicine had its origin in the far distant past. Primitive man, the ancient ancestor of the present generation, was a savage who roamed the earth, ignorant of the phenomena of his existence and of his surroundings. Fear of death was uppermost in his mind. He feared his fellow man and the wild beasts that inhabited the mighty forests, and fled in terror from such natural phenomena as thunder and lightning. He attributed all his misfortunes, including disease, to evil spirits that in his imagination peopled the air about him. To protect himself from these vile spirits he invented good spirits, charms and mystic rites. In due time some one member of the clan or tribe appeared to be more successful than others in combating these evil influences. This man became the magician or medicine man. He was the progenitor of the physician.

About four hundred years before the birth of Christ there lived in Greece a physician, whose name was Hippocrates. He became the greatest physician of his age. He was the first to recognize the error of mysticism, magic and religion in medicine. He taught that disease was cured by the natural powers of the body. He practiced bedside observation of symptoms, examined the secretions of the body and investigated the digestibility of various foods. He established the practice of medicine on a rational basis. He also composed a code of ethics to govern the conduct of physicians. He declared that the true physician must be a man of honor, true to himself, and honorable in his dealing with all men. This ancient code is the basis for the code of ethics that is in use today by the medical profession. In this day of many codes we of the medical profession can point with pride to this ancient code of ours that has been a lamp to guide the members of our profession throughout all the centuries of the past.

Gradually the science of medicine progressed until today we find not a finished product but a system that has reduced the incidence of disease to a point that is nothing short of miraculous. The death rate from disease has dropped to 9.6 per 1000, and nearly twenty years have been added to man's age expectancy. The number of newborn infants that may reasonably expect to reach maturity has been vastly increased. Trench after trench of man's great enemy, disease, has been taken in our war on that dread enemy of the human race. There remains much more to be done before disease will be entirely under control.

During all these centuries past, the physician has never faltered in his endeavor to serve suffering humanity.

Perhaps the most puzzling question a physician ever asks himself is this, What do people expect from a doctor? And that probably suggests another, How do they make their choice when they decide to call a doctor? The great majority of physicians have confessed an inability to get unqualified and uncolored answers to these questions.

The principal reasons for the selection of a particular physician may be attributed to ability and personality: the former consists of economy, willingness, reliability, honesty and quickness; the latter of confidence, warmth of heart and sympathy. Universally, there is a desire to find a doctor in whom perfect trust can be placed.

The personal side of the practice of medicine, which has always played an important and comforting part, steps in at such times and renders a service which the people not only desire but demand. Sympathy, kindness, pity and cheerful hope — no amount of scientific efficiency can take the place of these in the dark hours of sorrow and trouble so common in the experience of all. President Eliot, of Harvard University, once said, "In these intangible things are found the durable satisfactions of life; fame dies and honors perish, but loving kindness is immortal." I should not belittle the importance of science in medicine, — I bow in humble reverence before its beneficent power, — nor should I magnify the personal element, yet many of us know from experience what comfort, hope and assurance the personality of a trusted physician may bring to the bedside of his patient.

At one time parent was parent and child was child. Whether six or sixteen or even twenty-six, the relationship and cleavage between the two was a marked and positive one. Never might the young one infringe on the territory of his parent or question his authority or wisdom. Now this has all changed. Parent is still parent and child is still child, but the old relationship exists in mere skeleton. But in spite of this there is no gainsaying that the wise parent, the cultured and educated and intelligent parent, still owes the same responsible and well-directed guiding spirit and hand to his family. Understanding, subtlety and common sense now enter into the picture. The parent who is not understanding, is not subtle in his direction and does not use the utmost common sense will today fail in his task.

As the modern parent, so the modern physician. The young physician usually bears all the eagerness, all the restlessness, all the liberalism, all the anxious tempo of quick accomplishment. His virtue is his sincerity and his enthusiasm, but his handicap is inexperience. Who then is in a better position to temper the mood of the young, if not the informed older physician? With patience and tolerance borne of long acquaintance with every type of patient, with knowledge borne of many trying events, with experience in every type of case, hospital, scientific study and probable danger, he is in a position to be of lasting benefit to his junior. As the parent, so the senior physician can shape and guide and build and create so that the result in the young physician, grown to maturity, will be one of young scientific knowledge, tempered by old wise experience.

But let him be careful not to use the parental methods of half a century ago. Let him avoid the pitfall of brash and crass wordage, that I-am-older-than-you-and-therefore-know-and-say attitude which will bring him certain defeat. Let the senior physician be understanding. Let him remember his own youthful experiences, his youthful successes, his youthful defeats. Let him recall his own disillusionment at the lengths to which duty goes in calling upon the physician for public service and let him ever make it clear that it is never to be considered as a burden. Let him, through understanding, serve his junior physician and all mankind.

Let the senior physician be subtle. A scientific attitude requires open-mindedness and tolerance of large measure. Only through subtlety will this attitude be continually cultivated to greater and greater heights until it reaches the pinnacle of true service. So much more will be accomplished through the gentleness of subtlety than through the harshness of hard and cold untempered fact.

Let the senior physician feel called on more than ever to exercise his common sense. Let him realize he must not look back but ahead. He must not think in terms solely of the past. He must look to the future, knowing that the young physician will one day supersede him. Let him prepare for that day by revealing no weakness of personal character in learning from the junior, all the while he is teaching the latter the craft of the senior. Let him tax his reason to yield ever to the exigencies of the moment.

All these traits bear manifold relations to patient and physician, to student and practitioner.

Since we have had organized medicine we have made more progress and the science of medicine has reached a higher plane than was possible had each one continued in his isolated and selfish life. It is my belief that we are outstripping all other professions in progress and development today.

We are ever looking forward and blazing the trail for others.

The benefits given by the medical profession to the general welfare are but little understood and less appreciated. Where would we be today if medical science had done nothing toward the control of smallpox, diphtheria, typhoid fever and malaria? What would happen if the doctors went on a sit-down strike for ten years?

If the following achievements are realized by the medical profession, the life span will be lengthened still further: the further control and mastery of the remaining infectious diseases; an understanding of the factors that produce diseases of the heart and blood vessels; and the solving of the mystery of cancer and its cure. It is not an unfounded hope that makes me believe that these conquests will be realized some day. By the actual progress of investigations in physics, chemistry and biology now under way the problems presented by these great outstanding menaces to mankind are already partly solved. Their further solution depends on the continuance of scientific work, together with public education.

But let us be alert. Let us beware of pitfalls. There are wolves in sheep's clothing who would have us import some European system of medical care, with its paternalism, its regulation and its regimentation of both physicians and public, which, to my mind, are not in accordance with the American way of life. While dangling in plain view the bait of free medical service, they hide the concomitant necessity of compulsory sickness insurance out of the poor man's pay envelope, to cover not only the cost of medical care but the added expense of another bureau of regulators which would approximate if not exceed the Post Office Department in size and expense of personnel.

May we escape further centralization of power in this free nation. Propaganda in favor of taking the practice of medicine out of the hands of physicians and turning it over to be controlled by the politicians has been vociferous and without ceasing. A steady barrage of newspaper items, magazine articles, radio addresses and speeches has been aimed at the medical profession by these proponents of state medicine, with the obvious intention of breaking down the confidence of our patients in our trustworthiness.

Have we ever played into the hands of these gentlemen by what may have appeared to the patient and his family to have been a lack of sympathy, callousness or, perchance, the highly mercenary attitude? I wonder.

But I am talking too long. With this word I come to my conclusion. You remember that old custom of the monks of Aberdale. When they came to a house and asked for alms or food or shelter, if it was denied to them they were wont to raise their hands with cursing gesture and their voice in *Maledicite, maledicite.* But if they received their dole, the gesture was reversed and in their softest tones they spoke their gratitude in *Benedicite, benedicite.* Thus, it must be those who do know you who judge you wrongly and howl maledictions. I who have known you, who have felt of your favor, who have been warmed by your kindness — I who have gained a new respect for your power and an even greater confidence in your gentleness — I pronounce my humble but, believe me, my heartfelt, *Benedicite, benedicite.*

REPORT ON MEDICAL PROGRESS

ELECTROCARDIOGRAPHY IN GENERAL MEDICINE*

LAURENCE B. ELLIS, M.D.†

BOSTON

WITH the increasing availability of the electrocardiograph, every physician, general practitioner and specialist alike has occasion in these times to utilize this laboratory aid to cardiac diagnosis. One cannot hope to be truly adept at electrocardiographic interpretation without a considerable amount of study and experience, but every doctor should be able to answer these questions, What information will the electrocardiogram furnish, and what are its limitations? He should know when to demand an electrocardiogram in order to obtain vital information regarding his patient, and when a tracing is unnecessary or useless.

This article will endeavor to answer these questions. No attempt will be made to provide a résumé of electrocardiographic interpretation; there are several excellent texts which cover the subject adequately. Certain of the recent advances in electrocardiographic interpretation will, however, be mentioned.

With the development in 1903 of the delicate string galvanometer by the physiologist Einthoven, of Leyden, a new weapon was added to the armamentarium of those interested in the diagnosis and treatment of heart disease. Originally introduced as a laboratory aid in the study of the physiology of the heart, the electrocardiograph was quickly taken up by cardiologists, and soon became almost the hallmark of their special craft. In recent years, however, internists and general practitioners have to an increasing extent added it to their laboratory equipment. Although the bounds of its usefulness have, no doubt, not yet been fully explored, its value and its limitations are now fairly clearly defined, and at the present time the danger is not so much that electrocardiographic abnormalities will be missed by physicians not highly experienced in electrocardiographic interpretation, as that they will seek to use it beyond its limitations as an all-seeing eye for cardiac diagnosis, and will fail to correlate electrocardiographic findings properly with the clinical state of their patients.

The basic principle of the electrocardiogram is simple. Whenever a cell is activated, be it one which conveys a nerve impulse or a muscle cell which contracts, a difference in electrical potential is set up between the activated portion of the cell and the resting part, which can be detected by placing electrodes on the cell and registering the electrical changes by a sufficiently delicate galvanometer. Where a great number of such cells are involved, as in the heart as a whole, the record which is obtained is a summation of these electrical stresses registering in succession the phases of the cardiac cycle. The magnitude of the changes is a measure of the degree of unbalance of the stresses, and is not a measure of the mechanical force of the heart beat. Indeed, the point at which the heart is contracting most forcibly, that is, the peak of ventricular systole, may coincide with a point on the electrocardiogram where there is no deflection whatsoever. It is obvious, therefore, that only those conditions within the heart that produce electrical changes will be registered on the electrocardiogram; hence its usefulness will be limited within these bounds.

The type of electrocardiographic machine based on the string galvanometer introduced by Einthoven is still in use, but in addition the oscillographic type of machine, depending on the amplification of the minute electrical current by vacuum tubes, is now also very widely employed. A source of light conveys the image of the moving string or of the galvanometer mirror, to be registered on a moving photographic film. In addition, a time marker is usually introduced, so that there is direct photographic registration of time intervals of 0.04 and 0.20 second. Horizontal bands on the film permit the standardization of the record for each patient, so that a deflection of the string of 1.0 cm. is equivalent to 1.0 millivolt.

In taking electrocardiograms in clinical practice the electrodes are placed on certain arbitrarily chosen portions of the body with the heart lying between them, the body thus acting as a passive

*From the Thorndike Memorial Laboratory and the Second and Fourth Medical Services (Harvard), Boston City Hospital, and the Department of Medicine, Harvard Medical School.

†Associate in medicine, Harvard Medical School; assistant physician, Thorndike Memorial Laboratory, Boston City Hospital.

conductor. In order to obtain the maximum recording of electrical changes taking place in different directions, three successive arrangements of electrodes or leads are taken, labeled Leads 1, 2 and 3, and known as the "standard" leads. Lead 1 is obtained by connecting an electrode placed on the right arm to one on the left arm; Lead 2 extends from the right arm to the left leg; and Lead 3 extends from the left arm to the left leg. A triangle is thus formed enclosing the heart in three directions. Since the electrical axis of the heart normally lies nearly parallel with the axis of Lead 2, the various waves of the electrocardiogram tend to be higher in this lead than in Lead 1 or 3.

It will be noted that although the axes of the three standard leads cut the heart in different directions, they all lie in the frontal plane. Now, the heart being a three-dimensional organ, it must often happen that disturbances occur within it which would be registered only by electrodes placed along an anteroposterior axis. It would seem offhand that electrodes so placed that one was situated on the chest in the precordial area and the second directly behind it on the back would register this axis as desired. This is not exactly the case, however, because of the position of the heart in essential apposition to the anterior chest wall, while separated from the back by a comparatively thick layer of rather poorly conducting lung tissue. Since the registration of electrical disturbances is in inverse proportion to the distance from the electrode, it is obvious that the electrical changes produced in the neighborhood of that portion of the heart lying beneath the anterior electrode will dominate in producing the resultant electrocardiographic pattern. The chest leads therefore tend much more to localize than they do to depict the general composite pattern of the electrical changes occurring throughout the heart.

Chest leads have come into general use in clinical electrocardiography since the demonstration in 1932 by Wolferth and Wood[1] of their value in the diagnosis of fresh cardiac infarction. Since they are especially useful in detecting focal lesions, they are of particular help in revealing this condition, but their value is by no means limited to this state, and it is now the general practice to include a chest lead (Lead 4) in every electrocardiographic tracing.

As study of the technic of the chest lead progressed, it was soon found that a part of the body such as a leg or an arm would serve as well as the back for the indifferent electrode, and therefore, for the sake of convenience, the left leg or the right arm is now generally employed. The chest electrode is usually placed over the apex of the heart and the resulting leads are labeled Lead 4F or Lead 4R, depending on whether the left leg or the right arm is used for the indifferent electrode. Occasionally other precordial leads are utilized. Standard criteria for the taking and naming of these chest leads have recently been established by a joint committee of the American Heart Association and the Cardiac Society of Great Britain and Ireland.[2]

The Normal Electrocardiogram

In order to understand what the electrocardiograph is capable of doing and what one should not ask of it, a brief description of the normal electrocardiogram is necessary. This consists of several component parts, representing the successive phases of the cardiac cycle. Each wave or deflection from the isoelectric base line signifies a change in electrical potential produced by the spread of an impulse of excitation or the contraction of the cardiac muscle. To these successive waves the letters P, Q, R, S and T are applied (Fig. 1).

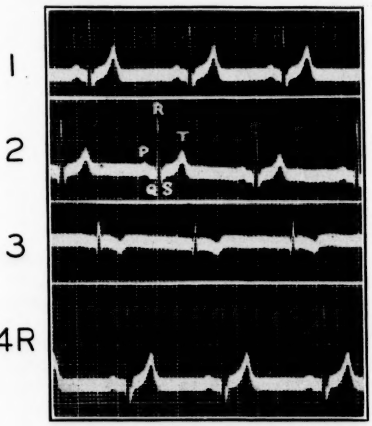

Figure 1. *Normal Electrocardiogram.*

Slight sinus arrhythmia; rate approximately 60; P waves upright in Leads 1, 2 and 4, not visible in Lead 3; PR interval = 0.14 second; QRS interval = 0.09 second; T waves upright in Leads 1, 2 and 4, inverted in Lead 3; axis normal.

The initial deflection, the P wave, is produced

by the spread of the wave of excitation from its origin in the sinoauricular node through the auricles and the contraction of these chambers. It is normally upright, in Leads 1 and 2 at least, and of small amplitude and short duration, and frequently is invisible in Lead 4 and even in one or two of the standard leads. If it is absent in all leads, however, it indicates that the auricles are not beating, as, for example, in the case of auricular fibrillation.

The PR interval, or the time interval from the beginning of the P wave to the commencement of the QRS complex, gives a measure of the speed of conduction between the sinoauricular and auriculoventricular nodes, and is usually between 0.14 and 0.16 second, with an upper limit of normal of 0.20 second or somewhat less,[3] depending on the age and size of the patient and the heart rate. When the PR interval exceeds the normal, partial heart block is present; this may be due to abnormal vagal stimulation, toxic damage or disease of the conducting mechanism. If greater interference with the conducting mechanism occurs, certain of the auricular impulses may be completely prevented from reaching the ventricles, resulting in dropped beats or 2:1, 3:1, 4:1, or complete auriculoventricular heart block.

Ventricular activity commences with the QRS complex. The wave of excitation spreads from the auriculoventricular node down the bundle of His and its right and left branches and through its arborizations to the ventricular muscle. The mass of tissue in the bundle of His and its main branches is probably too small and the speed of conduction too rapid to be registered to any extent on the electrocardiogram. The QRS complex, mainly at least, represents the invasion of the muscle by the excitation waves. The R wave is always upright; if the initial deflection is downward this portion is called a Q wave and if a downward deflection follows the R wave it constitutes an S wave. Normally the predominant wave in all leads is the upright R wave, and the Q and S waves are small and frequently missing altogether. The contours of the waves of this complex are normally sharp, and the total duration does not exceed 0.10 second. When the QRS interval is longer than this, damage to the conducting mechanism, known as intraventricular block, has occurred, and when these abnormal waves have a characteristic pattern it can be inferred that the delay is mainly in either the left or the right bundle. The maximum amplitude of the Q, R and S waves in the standard leads, which in normal persons means the R wave, is higher than either that of the P or the T wave, and is 0.5 millivolt or greater. If the maximum amplitude is less than this in all the standard leads, it suggests that myocardial disease is present, although in the absence of other electrocardiographic abnormalities it is unwise to diagnose heart disease from this sign alone. A certain percentage of normal persons show a minor degree of low voltage, possibly due to the position of the heart in the chest. Among other causes of low voltage in persons with normal hearts are pulmonary emphysema, generalized edema and effusions into the abdomen, chest and pericardium. Myxedema may produce such low amplitude, and a possible cause of finding low voltage erroneously is an improper standardization of the leads, especially in patients with high skin resistance (when the string-galvanometer type of machine is used).

When the S wave is more prominent than the R wave in Lead 3, the electrical axis of the heart, which very roughly corresponds to the anatomical axis, has been shifted to the left, or lies more nearly horizontally. If extracardiac causes for such a shift are excluded, the deviation usually represents a relative enlargement of the left ventricle, such as is seen in patients with hypertension or aortic regurgitation. If, on the contrary, the S wave is greater than the R wave in Lead 1, right-axis deviation is present, and is suggestive of relative right-sided cardiac enlargement, such as, for example, occurs with mitral stenosis or cor pulmonale.

The active phase of ventricular muscular contraction commences with the subsidence of the QRS deflections and is represented in the normal electrocardiogram by an isoelectric period, followed by a wave which is upright (except occasionally in Lead 3), the T wave. Ventricular systole ends and diastolic relaxation commences at or before the apex of the T wave. In pathologic states the normally isoelectric ST interval may be elevated above or depressed below the base line. Except when the QRS complex itself is markedly abnormal, or when there is a marked degree of axis deviation, significant degrees of such elevation and depression are usually associated with acute injury to the heart, and are mainly seen in patients with acute myocardial infarction or pericarditis.

The T wave, which normally has an amplitude of 0.1 to 0.5 millivolt, may become flattened or inverted under certain circumstances usually associated with toxic damage, ischemia or disease of the ventricular myocardium. Normally the T wave in Lead 3 is frequently flat or inverted.

The total duration of ventricular systole is roughly computed in the electrocardiogram from the QT interval, the normal limits of which vary with the heart rate and to some extent with the sex of the patient.[4] This interval may be prolonged as the result of heart disease, but also may be lengthened as the result of toxic states, as in uremia, or through the effect of quinidine.

Value of the Electrocardiogram

Bearing in mind what the electrocardiogram really is and what it registers, it will be of assistance in the diagnosis of pathologic cardiac conditions by demonstrating the following conditions:

I. Disturbances of rhythm
II. Disturbances of conduction
  (*a*) Between auricles and ventricles (auriculoventricular block of varying degree)
  (*b*) Within the ventricles (intraventricular and bundle-branch block)
III. Shift of the electrical axis of the electrocardiogram as the result of
  (*a*) Relative enlargement of one or more chambers of the heart
  (*b*) Displacement or rotation of the heart within the thoracic cavity
IV. Damage or disease of the myocardium as the result of
  (*a*) Toxic damage or infection
  (*b*) Coronary disease and myocardial ischemia
    (1) Acute myocardial infarction
    (2) Chronic coronary disease
  (*c*) Acute pericarditis
  (*d*) Pulmonary embolism

These will be considered in the following paragraphs.

Disturbances of Rhythm

Cardiac arrhythmias can usually be diagnosed by the electrocardiogram with a high degree of accuracy, and the polygraph has been almost entirely replaced in clinical use by the electrocardiograph for this purpose. Of course, many of the arrhythmias can easily be diagnosed at the bedside by palpation and auscultation, although one's adeptness at such bedside diagnosis is greatly enhanced by the check of an electrocardiogram. However, there are certain conditions which can be distinguished clinically with the greatest of difficulty or not at all, and they often carry very different indications for treatment. Thus it may be very hard to tell whether one is dealing with auricular fibrillation or numerous premature contractions, or even, on occasion, with sinus arrhythmia; and it is impossible clinically to judge whether extrasystoles arise from a single focus or multiple foci, although the latter are much more important. Paroxysmal auricular and ventricular tachycardia can be differentiated only by the electrocardiogram, and both are easily confused clinically with auricular flutter with 2:1 block, and with a rapid sinus tachycardia. Complete heart block and sinus bradycardia may be clinically indistinguishable, and high-grade partial heart block with a regular ventricular rhythm may be missed altogether clinically.

Disturbances of Conduction

Auriculoventricular block. Partial heart block resulting merely in a prolonged auriculoventricular block conduction time can only be diagnosed by the electrocardiogram or the polygram. The greatest importance of this finding as a diagnostic sign is in connection with rheumatic fever. At least 30 per cent of all patients with active rheumatic infection show a prolonged PR interval at some time during the course of the disease. This occurs quite irrespective of whether or not endocardial lesions develop. Since this electrocardiographic sign is so common in rheumatic fever and so rare in other types of arthritis, it is frequently of great help in establishing a diagnosis of this disease, which is very often obscure in its manifestations. Moreover, in those cases in which partial heart block is persistently present, the electrocardiogram furnishes a valuable guide as to the duration of activity.

Many other conditions can of course produce prolonged auriculoventricular conduction. Digitalis is perhaps the commonest cause, and the presence of partial heart block, together with other electrocardiographic signs of digitalis toxicity, may provide a helpful indication as to whether the patient has had too little or too much digitalis.

Any type of heart disease may produce transient or permanent partial block, provided the lesion is so situated as to interfere with auriculoventricular conduction. It is not, however, very commonly found as a permanent manifestation of chronic heart disease. It frequently does occur transiently in acute myocardial infarction of the posterior type, due usually to thrombosis of the right coronary artery. About 15 to 20 per cent of cases of posterior infarction show prolongation of the PR interval, and in about 3 per cent, higher grades of heart block are present.[5] Such prolongation may be the only electrocardiographic sign of cardiac infarction.

Higher grades of heart block, ranging from dropped beats to complete block, are merely ac-

centuations of partial heart block of the type discussed above and are due to precisely the same causes.

Intraventricular and bundle-branch block. Intraventricular and bundle-branch block can only be diagnosed with certainty by the electrocardiogram. The terminology and exact electrocardiographic diagnostic criteria for the various types of bundle-branch block have undergone a good deal of modification during the past few years. It is probably wisest at the present time to adopt the criteria laid down by the New York Heart Association.[6]

Bundle-branch block is a nonspecific sign, but is usually the result of chronic organic heart disease. In occasional cases, however, it may be temporary as the result of some toxic effect on the heart or may be produced by coronary thrombosis, or, in rare cases, it may be functional. Although permanent bundle-branch block may be rarely produced by some static focal lesion in a heart otherwise undamaged, in most cases it is an indication of widespread and progressive cardiac damage, and hence its discovery is a relatively serious prognostic sign. However, if the patient survives a year after the discovery of this electrocardiographic abnormality, his prognosis would seem to be considerably improved, since the block is then much more likely to be due to a focal lesion.

Records which show a very minor degree of prolongation of the QRS interval (0.11–0.12 second), especially when associated with high voltage and if unaccompanied by other electrocardiographic abnormalities, may prove very confusing and difficult of interpretation; under such conditions one should avoid a dogmatic interpretation, but should consider the record only in the light of the clinical findings.

One type of bundle-branch block which deserves special mention, because it has only recently been described and because it carries with it a favorable prognosis, is bundle-branch block associated with a short PR interval (0.10 to 0.12 second), occurring in patients with otherwise normal hearts who may be subject to attacks of paroxysmal tachycardia or fibrillation.[7] Interestingly enough, these individuals usually show normal QRS complexes during the periods of tachycardia, and normal complexes can frequently be induced at other times by the administration of large doses of adrenalin or atropin. The electrocardiograms of this type are usually distinguished by a slurring of the upstroke of R_1, a finding rarely if ever present in organic bundle-branch block where the delay is in the down stroke. The probable cause of this functional condition is an accessory pathway of conducting tissue between auricles and ventricles (bundle of Kent) which conveys the impulse with great rapidity to a point below the auriculoventricular node. The following case history is cited as an example of this condition and also as an illustration of the harm that a wrong electrocardiographic interpretation can do.

The patient, a 23-year-old student, had had an "attack" a year previously in another city, which consisted of faintness, palpitation and tachycardia, some dyspnea and mild precordial oppression. It had come on while he was playing ball and had lasted about 3 hours. By the time he was seen by his physician, the acute phase of the attack had passed off but his heart was still rapid and irregular. His past history and family background were negative as to any pertinent facts. His physician called a consultant, who saw him at a time when his heart was once more slow and regular. Two electrocardiograms were taken at intervals of a few days, and, apparently largely or entirely on the basis of the electrocardiographic interpretation, a diagnosis of acute myocardial infarction was made. Bed-rest was carried out for several weeks and the patient was then gradually allowed to resume full activity. When I saw him a year later he was feeling quite well, except for the natural anxiety occasioned by the serious prognosis he had been given. At this time a further history of transient attacks of rapid palpitation on two or three occasions, occurring during the course of physical activity, was elicited. Physical examination and x-ray measurements of the heart were completely normal. An electrocardiogram showed left bundle-branch block with slurring of the upstroke of the R wave and a PR interval of 0.11 second. Comparison of the two previous records with this tracing showed them to be essentially the same, since they differed from each other only in minor details of the QRS and T waves. An attempt to change the form of the ventricular complexes by the administration of atropin was unsuccessful, but following the intravenous injection of a very small amount of adrenalin perfectly normal QRS complexes were produced for a few minutes.

It seems quite certain that this young man had the type of bundle-branch block described above, and that the attack which he had suffered a year previously was a paroxysm of auricular tachycardia or fibrillation. The unfavorable prognosis he received was quite unjustified. Much harm could have been averted had the original electrocardiogram been correctly interpreted and the clinical symptoms properly evaluated.

Shift of the Electrical Axis

Frequently but by no means invariably, enlargement of the left ventricle is accompanied by left-axis deviation, while right-sided enlargement results in right-axis deviation.

The same findings, however, that occur with cardiac enlargement may, to a certain extent at least,

take place when the position of the heart within the chest is shifted by extracardiac conditions such as high diaphragm, fluid or air in the pleural cavity, or collapse or fibrosis of the lung. With a marked degree of left ventricular enlargement it is not uncommon to find the ST interval slightly depressed in Lead 1 and raised in Lead 3, with an inverted T_1 and an upright T_3. This pattern is not found when the heart is simply displaced upward and outward by a high diaphragm. Under these circumstances the ST intervals are isoelectric, and the T waves upright, although T_3 may be inverted on occasion.

Myocardial Damage or Disease

Resulting from toxic damage or infection. These changes, which are often associated with disturbances of auriculoventricular or intraventricular conduction and with shifts in the electrical axis, are frequently nonspecific so far as the electrocardiographic pattern is concerned. They are manifest by flattening or inversion of the T waves, deviation of the ST interval above or below the isoelectric base line, prolongation of the QT interval and diminution of the voltage of the QRS complexes. These abnormalities may be present singly or in a variety of combinations. Digitalis, for example, typically produces a characteristic spoon-shaped inversion of the T waves, whereas quinidine tends to lengthen the QT interval. The QT interval may also be prolonged as the result of toxic states such as uremia and other types of acidosis, in beriberi heart disease, as well as in hypertensive or arteriosclerotic heart disease. Depression of the ST interval with flattening or inversion of the T waves in one or more leads is also seen in beriberi heart disease,[8] as well as in some cases of severe anemia,[9] and, according to Scherf,[10] the same pattern is commonly found in electrocardiograms of women at the menopause. Severe myxedema typically produces a low voltage in all complexes, and low voltage is also found in myocardial disease of various types. Minor degrees of it may occur in apparently normal people, as has been mentioned above, so that not much reliance should be placed on this sign alone if present only to a slight degree and unaccompanied by other abnormalities.

Resulting from coronary disease and myocardial ischemia. The greatest clinical value of the electrocardiogram undoubtedly lies in the information it provides that enables us to diagnose acute myocardial infarction, usually associated with coronary thrombosis. The electrocardiographic pattern is often characteristic, and frequently the diagnosis can be made with certainty from a single record. Yet even here a word of caution is in order against interpreting the electrocardiogram without considering the clinical picture. Even the characteristic pattern of myocardial infarction may be confused with that produced on occasion by pulmonary embolism or by acute pericarditis. Not infrequently atypical changes occur, or the record may be taken either before marked changes have had time to be produced or after they have progressed to the stage when they are no longer specific for an acute lesion. Under these conditions serial electrocardiograms may furnish the information which a single tracing fails to reveal.

In general, the majority of electrocardiographic records taken on patients with a large acute myocardial infarction fall into either the Q_1T_1 or Q_1T_3 type, signifying a so-called "anterior" or "posterior" infarction.[11] These patterns have been well described in the literature as well as in the recent editions of textbooks on electrocardiography, and will not be given here.

Recently the electrocardiographic changes which are found in so-called "lateral" infarction have been described.[12] These consist of depression of the ST segments in Leads 1 and 2 as well as in the precordial lead, especially when the last is placed over the apex. These patients frequently have auricular fibrillation and hence are likely to have received digitalis, which may produce electrocardiographic changes very similar to those resulting from lateral infarction. Moreover, the changes in this type of infarction may disappear rapidly and completely.

As mentioned above, atypical electrocardiographic abnormalities occur which conform to none of the above-mentioned patterns. In some cases they have characteristics of a combination of anterior or posterior lesions, while in others they are quite nonspecific and only the changes taking place in serial records, combined with the clinical findings or the autopsy correlation, demonstrate that they are in reality due to an infarction. It is not surprising that atypical patterns are sometimes found, because not only is the muscular structure of the heart complex, but extraordinary changes in the coronary circulation may take place, with a very varied clinical picture.

It is hazardous to make a prognosis from the electrocardiographic evidence in cases with myocardial infarction. Sometimes one can find evidence that progression of the thrombosis or a new infarction has taken place by the recurrence of acute changes, and, in general, patients whose records show a marked improvement and a return

toward normal within a short period of time have a less severe focal lesion than those whose records do not. But even here prognosis has to be guarded, because one never knows how much disease there may be elsewhere in the heart and the coronary arteries or when another thrombosis will take place.

Electrocardiographic abnormalities which occur as the result of chronic myocardial ischemia secondary to coronary disease may have resulted from an acute cardiac infarction in the past or from slowly developing coronary insufficiency. It is sometimes possible that an acute incident did occur at some time in the past, but on the whole the findings are nonspecific and similar to those resulting from myocardial damage of toxic or infectious origin.

Characteristic traces of cardiac infarction may persist in the electrocardiographic record for the rest of the patient's life. On the other hand, an infarction, and particularly repeated infarctions, may result in a nonspecific abnormality of the electrocardiogram which is indistinguishable from that produced by diffuse myocardial fibrosis secondary to coronary disease without gross infarction — or, indeed, from toxic or infectious myocardial damage.

Resulting from acute pericarditis. In recent years a number of articles have been written describing the electrocardiographic changes which may occur in the course of acute pericarditis.[13, 14] The most striking change that may take place is an elevation of the ST interval in some of or most characteristically in all the three standard leads, and often in the precordial lead as well, especially if it is taken from the right arm to the apex. These electrocardiographic changes are especially apt to be present in purulent pericarditis or hemopericardium, but they may occur in any type of acute pericarditis. They are often present only during the first few days of the pericarditis, and may then disappear in spite of the continuance or progression of the pericardial disease. Changes in the T waves may also occur; these may follow the alterations in the ST segment or may be seen as the initial manifestation. They consist of inversions which occasionally occur in all three standard leads as well as the chest lead, a finding rarely seen in any other condition.

The electrocardiographic abnormalities which are found in acute pericarditis were originally thought to be due to the pressure of the accumulating pericardial fluid exerting a tamponade effect on the heart. Though this may possibly be true in a few cases which show very rapid and marked accumulations of fluid, the more probable explanation in most cases is that they are due to a superficial subepicardial myocarditis, which occurs as the result of the penetration of the pericardial inflammatory process into the superficial layers of the heart.

Since pericarditis is often missed clinically, and since it is so important that purulent pericarditis be diagnosed early and correctly, the electrocardiogram offers a means by which this diagnosis can be made in a considerable percentage of cases.

The condition with which the electrocardiographic changes of acute pericarditis are most often confused is acute myocardial infarction. Although the patterns in the two conditions are in many ways similar, if it is borne in mind that characteristically the ST interval alterations and sometimes the T-wave changes of pericarditis involve all three standard leads, and that changes in Q waves are absent, mistakes in diagnosis are not likely to occur often. It should be remembered that pericarditis may occur in the course of myocardial infarction, and that hence the electrocardiogram may reflect both conditions.

Resulting from pulmonary embolism. In 1935 McGinn and White[15] described a characteristic electrocardiographic pattern occurring in certain cases of pulmonary embolism. This consists of the appearance of a prominent S_1 and Q_3, a depression of ST_1 and ST_2 with staircase ascent, and an inversion of T_3 with upward convexity of ST_3. Since the publication of their article a number of reports on this subject have appeared, the latest of which, by Sokolow, Katz and Muscovitz,[16] not only comprises a relatively large series, but also well summarizes the present status of this rather controversial subject. In brief, out of 50 cases they found 5 which fulfilled McGinn and White's criteria. In 9 there were no significant electrocardiographic changes. Twenty-seven showed nonspecific changes, which for the most part consisted of one or more of the abnormalities described by McGinn and White, and in 9 there were present some of the characteristics of recent myocardial infarction, usually of the posterior type. The absence of the full-blown picture of myocardial infarction, the failure of the T-wave changes to evolve through a characteristic sequence of changes and the tendency for the abnormalities to disappear made the differentiation from cardiac infarction possible in the majority of cases. There was no correlation between the type of electrocardiographic changes encountered and the nature or extent of the pulmonary infarction.

Limitations of the Electrocardiogram

There are certain questions which the electrocardiograph will not answer. The two most im-

portant are the presence or absence of valvular disease, and the degree of impairment of the cardiac reserve. Since the valves neither convey neurogenic impulses nor have muscle, there is no direct registration of their action on the electrocardiogram. The only evidence that the electrocardiogram ever gives of valvular disease is the indirect evidence suggesting relative enlargement of certain chambers of the heart, which may occur characteristically in various types of valvular disease. The question that is so frequently asked, for example, This patient has a systolic murmur: does he have mitral disease? cannot be answered.

The electrocardiogram tells us nothing about the functional capacity of the heart. We cannot judge from it whether a patient is suffering from congestive heart failure or from angina pectoris. A man may be dying from heart failure and still have a normal electrocardiogram, and contrariwise he may show a most abnormal record and still be capable of normal activity. It cannot be emphasized too strongly that an electrocardiogram should not be isolated and considered out of relation with the patient himself. As with all information gained in the laboratory, an electrocardiographic interpretation should always be assessed in the light of the clinical findings.

There are three general types of error which frequently occur when such a clinical correlation is not properly made. First, a normal electrocardiogram may be found in a person who has organic heart disease, and because undue weight is laid on it the correct diagnosis is missed and the patient is improperly treated. Second, an incorrect diagnosis of serious heart disease may be made on the basis of the electrocardiogram alone, which has been wrongly interpreted as being pathologic when actually all that was present was artefact, or minor physiologic variation, or change which might be either functional or organic in nature. Third, nonspecific electrocardiographic abnormalities may be wrongly interpreted.

Many of the abnormalities which the electrocardiograph records are nonspecific; that is, they may be produced by any of several disease processes or toxic effects acting on the heart. Moreover, certain deviations from the normal which the electrocardiogram may show may be merely extremes of physiologic variations. With the exception of a very few pathognomonic electrocardiographic findings, mainly concerned with arrhythmias, and to some extent with acute myocardial infarction, an electrocardiogram can be intelligently interpreted and its significance be properly evaluated only by considering it in relation to the whole clinical picture and other laboratory findings. Considered in this way, the electrocardiogram offers much that is of value. When it is taken out of its context and too much stress is laid on it, the dangers resultant from an unwise interpretation are as great as is the helpful information it provides.

References

1. Wolferth, C. C., and Wood, F. C.: The electrocardiographic diagnosis of coronary occlusion by the use of chest leads. *Am. J. M. Sc.* **183**:30-35, 1932.
2. Joint recommendations of the American Heart Association and the Cardiac Society of Great Britain and Ireland: standardization of precordial leads. *J. A. M. A.* **110**:395, 681-683, 1938. Also *Am. Heart J.* **15**:107, 235, 1938.
3. Ashman, R., and Hull, E.: *Essentials of Electrocardiography: For the student and practitioner of medicine.* 212 pp. New York: The Macmillan Co., 1937. P. 38.
4. Shipley, R. A., and Hallaran, W. R.: The four-lead electrocardiogram in two hundred normal men and women. *Am. Heart J.* **11**:325-345, 1936.
5. Master, A. M.; Dack, S., and Jaffe, H. L.: Partial and complete heart block in acute coronary artery occlusion. *Am. J. M. Sc.* **196**:513-529, 1938.
6. The Criteria Committee of the New York Heart Association: *Nomenclature and Criteria for Diagnosis of Diseases of the Heart.* Fourth edition. 282 pp. New York: New York Heart Association, 1939. Pp. 132-134.
7. Wolff, L.; Parkinson, J., and White, P. D.: Bundle-branch block with short P-R interval in healthy young people prone to paroxysmal tachycardia. *Am. Heart J.* **5**:685-704, 1930.
8. Weiss, S., and Wilkins, R. W.: The nature of the cardiovascular disturbances in nutritional deficiency states (beriberi). *Ann. Int. Med.* **11**:104-148, 1937.
9. Ellis, L. B., and Faulkner, J. M.: The heart in anemia. *New Eng. J. Med.* **220**:643-952, 1939.
10. Scherf, D.: The respiratory and the circulatory system in females with ovarian dysfunction. *Ann. Int. Med.* **13**:1414-1430, 1940.
11. Parkinson, J., and Bedford, D. E.: Successive changes in electrocardiograms after cardiac infarction (coronary thrombosis). *Heart* **14**:195-239, 1928.
    Barnes, A. R., and Whitten, M. B.: Study of the R-T interval in myocardial infarction. *Am. Heart J.* **5**:142-171, 1929.
12. Wood, F. C.; Wolferth, C. C., and Bellet, S.: Infarction of the lateral wall of the left ventricle: electrocardiographic characteristics. *Am. Heart J.* **16**:387-410, 1938.
13. Schwab, E. H., and Herrmann, G.: Alterations of the electrocardiogram in diseases of the pericardium. *Arch. Int. Med.* **55**:917-941, 1935.
14. Vander Veer, J. B., and Norris, R. F.: The electrocardiographic changes in acute pericarditis. *J. A. M. A.* **113**:1483-1487, 1939.
15. McGinn, S., and White, P. D.: Acute cor pulmonale resulting from pulmonary embolism: its clinical recognition. *J. A. M. A.* **104**:1473-1480, 1935.
16. Sokolow, M.; Katz, L. N., and Muscovitz, A. N.: The electrocardiogram in pulmonary embolism. *Am. Heart J.* **19**:166-184, 1940.

Erratum. In the "Report on Medical Progress: Pathology," by Dr. Tracy B. Mallory, in the May 30 issue of the *Journal,* the sentence starting on line 17 of column 2 on page 924 should read as follows:

> The rate of healing was found to be inversely proportional to the size of the infarct and directly proportional to the adequacy of the remaining coronary circulation.

CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

ANTEMORTEM AND POSTMORTEM RECORDS AS USED IN WEEKLY CLINICOPATHOLOGICAL EXERCISES

FOUNDED BY RICHARD C. CABOT

TRACY B. MALLORY, M.D., *Editor*

CASE 26261

PRESENTATION OF CASE

A fifty-six-year-old Danish housewife was admitted to the hospital for study.

The patient had enjoyed good health until two years before admission when several of the following symptoms appeared almost simultaneously. Possibly the first symptom in its order of appearance was that of pain in the lower thoracic region of the spine, which radiated forward toward the midline beneath the breast on the left side. She complained of "sticky" pains over the left chest anteriorly, occasionally precordial, lasting sometimes five minutes and accompanied by palpitation and shortness of breath. Dyspnea with exertion was noted from such bland acts as walking slowly out of doors or bending over while at work in her home. Hair appeared on the upper lip and became quite noticeable, as did that on the side of her face; at the same time the hair on her head came out in "bunches." Approximately one and a half years before admission she began to notice flushing of the face and neck and the skin showed eruptions which appeared to have been acneform. All these symptoms persisted and increased in severity. It then became difficult for her to talk. She became worried about her symptoms and a physician was called.

Roentgenograms of the chest showed cardiac enlargement. The physician then prescribed "green pills," which she continued taking until one week before admission. She was sent to an outside hospital four months before admission, where she stayed for more than two months and was then referred to a sanatorium. During this time edema of the ankles appeared and her eyes began to "water." She was referred from the sanatorium to this hospital for further study.

The patient came to the United States at the age of eighteen. She had had the usual childhood diseases, but no scarlet fever or diphtheria. At the age of twenty-two she had had typhoid fever, with an uneventful recovery. There had been no other illnesses of any significance. The patient weighed about 144 pounds, and there had been no recent change. Catamenia began at the age of sixteen, occurred once every twenty-eight days, lasted one week and tended to be profuse. She had had the menopause at the age of forty-five. There had been no discharge or bleeding since that time. She had been married at the age of twenty-seven and had had six children, one of whom died at an early age of heart disease. The remaining children and husband were living and well. The family history was negative.

Physical examination revealed a short, stocky woman whose face, neck and upper thoracic regions were flushed. The hair was soft, fine, sparse and greasy. There was a rough, stubby growth of hair over the face, upper lip and chin, where the patient had recently shaved. No abdominal striae were noted. The skin showed multiple acneform lesions over the upper chest anteriorly. The heart was somewhat enlarged to the left. The signs were muffled, and no definite murmurs were audible. The blood pressure was 170 systolic, 100 diastolic. There were rales at both lung bases. The spleen was just palpable with the patient on the left side. There was a right dorsal, left lumbar scoliosis. Examination of the genitalia revealed that the mucous membranes were "highly colored." There were many redundant vaginal folds, and because of this the cervix was not visualized. The clitoris was slightly larger than normal. The visual fields were normal. The fundi were not well observed. The neurological examination was negative.

The temperature, pulse and respirations were normal.

Examination of the blood showed a red-cell count of 5,500,000 with 78 per cent hemoglobin (Sahli), and a white-cell count of 11,400 with 65 per cent polymorphonuclears; the smear was normal. Examination of the urine was essentially negative. The plasma volume was 2554 cc., or within normal limits, and the extracellular fluid volume was 12,370 cc., a low normal. The weight was 139 pounds. A blood Hinton test was negative. The blood sugar was 110 mg. per 100 cc., the plasma nonprotein nitrogen 26 mg., the serum calcium 9.7 mg., the serum phosphorus 3.2 to 4.0 mg., and the serum phosphatase 5.24 units. A glucose tolerance test by the venous capillary method, using the macro and micro technics, showed an elevated flat curve during the four-hour interval of the test. The urinary samples taken during the last two, three and four hours

showed yellow-brown and green tests with Benedict's solution. The second, third and fourth hour macro tests on the blood gave readings of 412, 304 and 250 mg. per 100 cc. respectively. The micro tests were similarly elevated. The phenolsulfonephthalein test showed 40 per cent excretion in thirty minutes and 65 per cent in one hour. The plasma chlorides were equivalent to 102 cc. of N/10 sodium chloride per liter; the carbon dioxide combining power was 74.0 vol. per cent, the total cholesterol 144 mg. per 100 cc., and the serum sodium 147.9 milliequiv. per liter. A urinary female-sex-hormone test was slightly positive. An electrocardiogram showed a ventricular rate of 85 with frequent auricular premature beats, a PR interval of 0.14 second, a QRS duration of 0.12 second, left-axis deviation and left bundle-branch block.

Roentgenograms of the spine showed marked scoliosis of the upper dorsal spine to the left and of the lower dorsal spine to the right, with corresponding deformity of the rib cage. Chest plates showed the diaphragms high in position, particularly on the left, with the heart in the transverse position. The heart was enlarged in the region of the left ventricle. There was a markedly tortuous, elongated aorta without gross dilatation. The lung fields were clear. The visible bones appeared decalcified. There was marked development of the subcutaneous fat. A flat film of the abdomen showed the left kidney displaced markedly downward and located so that it was seen end on. The displacement was produced by a round 15-cm. soft-tissue mass which occupied the place between the displaced kidney and the diaphragm. The spleen was displaced laterally. In the lateral view about three fourths of this tumor lay in the front of the spine and one fourth lateral or posterior to the lumbar vertebral bodies, the posterior aspect of the tumor lying against the descending posterior part of the diaphragm. After intravenous injection of dye there was prompt excretion on both sides. The kidney pelves appeared to be normal. A film of the skull showed no gross evidence of disease. In roentgenograms following air-injection the right perirenal tissues and adrenal gland were fairly well visualized. The adrenal gland appeared slightly larger than normal, and its density was approximately that of the kidney. On the left there were comparatively small amounts of air visible surrounding the kidney, as well as a tumor mass in the region of the adrenal gland. The mass was separated from the diaphragm by air with the exception of a small space in the center of the diaphragm. The mass appeared lateral and anterior to and well separated from the spleen. By a gastrointestinal series, the mass displaced the stomach forward and slightly toward the right. Occasionally the stomach was displaced even more laterally, thus showing that it was not adherent to the mass though it must have been in close contact.

Further data obtained while in the hospital revealed that the patient had suffered with paroxysmal nocturnal dyspnea, ankle edema and precordial pain that was brought on by effort, especially after meals, and was relieved by rest. These symptoms were associated with dyspnea and were minimal after the three months' period of hospitalization before admission. The patient was placed on 1½ gr. of digitalis daily, was given intravenous Salyrgan twice each week and treated with bed rest. She continued to show rales at both lung bases, but there was no evidence of peripheral edema. The blood pressure remained around 170 systolic, 90 diastolic. A tourniquet test performed with the blood pressure at this level showed no petechiae on immediate release of the tourniquet.

Approximately one month after admission a right adrenal exploration was performed. A very small normal adrenal was found and biopsied. The postoperative course was uneventful. Some two weeks later left adrenal exploration was performed.

Differential Diagnosis

Dr. Aubrey O. Hampton: You can see this large mass in the lateral view displacing the stomach forward and medially. The intravenous pyelogram shows the upper pole of the kidney at the third lumbar vertebra. The mass is smooth and rather oval, and the shadows of the spleen and of the upper pole of the kidney can be definitely separated from it. There is probably one correction that should be made in the statement about the air injection; that is, the right adrenal is not distinctly seen. There is a round shadow in the region but it does not look like that of the adrenal gland. It does not fit the top of the kidney.

Dr. Alfred O. Ludwig: How about the degree of decalcification?

Dr. Hampton: For a woman of that age, I should not get too excited about it; there is a fair amount but nothing unusual.

Dr. Ludwig: The x-ray findings localize the dis-

turbance in the region of the adrenal gland. This patient presented a picture which may have been caused by a number of different conditions. In the first place we have symptoms that appear to have been secondary to the hypertension, with some myocardial involvement and very mild cardiac failure. The electrocardiogram showed evidence of myocardial damage insofar as she had left bundle-branch block.

The most striking symptoms are those referable to the endocrine system. She noticed the appearance of hirsutism, and some difficulty in speech, which is not specified. What was the change in speech?

DR. OLIVER COPE: Not much more than language difficulty.

DR. LUDWIG: I should have liked to have had you say her speech was hoarse and deep, but that apparently was not the case. This all appeared about eleven years after the menopause in a woman who had had a perfectly normal menstrual history and had borne six children. Physical examination showed a little obesity and general hirsutism, with soft fine hair and marked increase in facial hair, so that she had to shave. There were also acneform lesions of the skin. All these symptoms and signs could occur with an adrenocortical tumor, and it seems to have been localized by x-ray studies, particularly following air injection.

In regard to the laboratory work there was an increase in the red-cell count to 5,500,000; these cases of adrenocortical tumors may show considerable polycythemia. The blood volume was apparently normal, but there have been cases reported in which it was decreased. The sugar tolerance was decreased — a common finding in this type of tumor. The serum calcium and phosphatase were normal; one phosphorus value was on the low side, but she did have values as high as 4 mg. per 100 cc., which is normal. The chlorides were normal. There was good renal function as shown by the phenolsulfonephthalein test. The serum sodium was slightly elevated, the cholesterol within normal limits, and the carbon dioxide combining power high.

The main problem in seeing this patient for the first time would be to establish a diagnosis, and the differential diagnosis that I should consider lies between Cushing's syndrome, or pituitary basophilism, and adrenocortical tumor.

Should any other disturbances be considered? One that occurs to me is arrhenoblastoma, an ovarian tumor that is also associated with hirsutism, but with an otherwise different picture, the arrhenoblastoma being a masculinizing tumor. Hirsutism occurs to be sure, but there may also be loss of hair with baldness, and atrophy of the breasts and genitalia, except for the clitoris and labia majora, which increase in size. Polycythemia is usually present. Acne of the skin is not found, nor are there marked changes in the bones. Usually there is a weight loss rather than obesity, although at times fat deposits may occur. With this type of tumor the diagnosis is usually made by palpation of a pelvic tumor in the region of one ovary, the uninvolved ovary being impalpable. The sugar tolerance may vary, but it is usually not decreased. The blood pressure and basal metabolic rate may also vary, and give no direct clues. The Aschheim-Zondek test is usually negative.

So far as Cushing's syndrome is concerned, I can suggest no method other than perirenal air injection to differentiate clinically between Cushing's syndrome, or basophile tumor of the pituitary, and adrenocortical tumor. Obesity, hirsutism, decalcification and genital changes with enlargement of the clitoris occur in both. In one case that I looked up, Dr. Cushing stated that increase in the size of the clitoris was not so common in the pituitary as in the adrenal cases, but that does not seem to be generally true as some of the former have been reported with enlargement of the clitoris. In adrenocortical tumors the symptoms that appear depend on the time of life in which the tumor occurs. These are usually tumors of the adrenal cortex, either adenomas or occasionally carcinomas. They may occur in males before puberty, producing the so-called infantile Hercules type with premature growth of hair and enlargement of the genitalia. Male hormones appear in the urine, except in boys under the age of ten; there is rapid growth but later a cartilage loss so that these individuals may be shorter than normal. They tend to be obese. The same syndrome also may occur in young individuals with pineal tumors. In males after the age of puberty adrenal tumors may occur without any symptoms, but endocrine disturbances may begin with polydipsia, hypertrophy of the genitalia or changes in metabolism, usually with increase in secondary sex characteristics tending toward feminism. In females before puberty the cases reported have tended toward pseudohermaphroditism and toward adult masculinity with increased hair growth, increase in the size of the clitoris and labia majora, absence of menstrual periods and change in voice toward the masculine side. Adrenal tumors in females may occur without any endocrine symptoms, and when they do exist they again tend

toward masculinization, with amenorrhea. There may be baldness. The excess hair tends to fall out after the tumor is removed. The genital changes are marked in young patients: the ovaries are small, the clitoris and the labia majora large, the breasts atrophied. Sterility is present, but there are cases in which pregnancy has occurred after the removal of the tumor.

The diagnosis of adrenocortical tumor depends on this technic of air injection which Dr. Cope can tell you more about than I. Before that was done the only way to prove the presence or absence of these tumors was by exploration of the adrenal glands. There are a few other points which I cannot discuss adequately, such as the assay of androgenic substances in the urine, which in the presence of some of these tumors increase markedly, although I understand there are some cases in which the androgens are normal. These syndromes may also occur from hyperplasia of the adrenal cortex without the presence of tumor. There are a few other clinical points of differentiation which have been suggested. I do not know how valid they are, but it is said that the pituitary type of hirsutism is lanuginous as contrasted with the ovarian type which is universal and masculine in distribution and the adrenal type which is said to be a growth of coarse dark hair with wide distribution. Pituitary obesity is said to be of the girdle type, ovarian obesity is more general, and adrenal obesity tends to involve the face, neck and body and to be less marked in the extremities. I should like to hear from someone better versed in endocrinology as to the possible significance of hormone tests in the differential diagnosis of these various conditions. I shall make a diagnosis of adrenocortical tumor.

Dr. Cope: It is a difficult case to discuss since the diagnosis is so obvious, but it was not quite so obvious as the record implies. Before the patient came to us she passed through many hands; at first she was classed as a cardiac patient and then as someone suffering from general malignancy. One of our former surgical housefficers first suspected the diagnosis. She shows a combination of the virilism syndrome, if I may call it such, and basophilism. Complete hormonal studies were not done because 17-ketosteroid assays were not available when she was here two years ago. Have not assays been subsequently done on the urine which had been kept?

Dr. Ann T. Forbes: Yes; she had a high titer, 70 mg.

Dr. Cope: A titer of 70 mg. in twenty-four hours is nearly tenfold more than the average normal woman would show at this age, the upper limit being around 12 to 13 mg.

The surgeon was presented with a problem, and I should like to point out the usefulness of the air-injection technic. We did not inject air merely to demonstrate a tumor that was obvious in the plain film. In a person of this age the tumor might well be malignant, and we were therefore interested to know whether the tumor was adherent: the more adherent the less likely we could excise it in toto. After injection you can see the air surrounding the tumor in various views, both on the lateral and anterior plates. The air surrounded the tumor except for one area. We could, therefore, conclude that the tumor was resectable. That is one definite use for air injection.

Dr. Hampton brought out a second point, which is not in the original record. When we did the injection we considered this shadow on the right might be the adrenal gland. None of us would make such a statement now because of the absence of characteristic form: it is fat rather than the adrenal gland. The record from which this abstract was prepared states that there was probably a normal adrenal gland on the right, just below the liver. We were not sure, however, and the right side was explored first, the reason being that excision of an adrenocortical tumor in toto is followed by a very high mortality, which in the literature is between 30 and 40 per cent. It is my belief that this mortality is due directly to acute adrenocortical insufficiency. With the excessive secretion from the tumor on one side, the normal adrenal gland on the other side atrophies from disuse, and at the time of operative removal of the tumor, there is insufficient normal adrenal tissue left to continue normal function. So the first thing in this patient was to explore the right adrenal gland.

As the record states, a very small right adrenal gland was found. Three weeks later the large adrenocortical tumor on the left was exposed, and a subtotal excision performed. I did not believe there was enough adrenal cortex on the right side to carry on the normal requirements for cortical hormone, so I left a portion of the tumor behind. Today we should give desoxycorticosterone acetate preoperatively, but this synthetic substance was not available at that time.

Dr. Ludwig: I should like to ask Dr. Cope to state the difference between pituitary basophilism

and adrenal tumor from the hormonal point of view.

DR. COPE: So far as I know one cannot. We have had one patient with an ovarian arrhenoblastoma, for example, who had a normal 17-ketosteroid excretion.

DR. LUDWIG: Most cases of pituitary basophilism have either hyperplasia or adenoma of the adrenal cortex as well.

DR. COPE: At the Peter Bent Brigham Hospital Dr. Joseph C. Aub has studied a girl who has been completely rid of basophilism following x-ray treatment of the pituitary gland, and I believe there is a primary disease arising in the pituitary gland as well as in the adrenal cortex. By the tests that have so far been devised, no method has been found to differentiate physiologically these true cases of pituitary basophilism and those of adrenocortical basophilism. The virilism syndrome is also unsettled. One of our patients with an arrhenoblastoma showed a normal urinary excretion of 17-ketosteroid for a woman of her age. This is an extraordinary observation because she was a masculine type of woman with amenorrhea; after the removal of the tumor the menses returned promptly and she became pregnant. Such a woman must obviously have a masculinizing hormone that we do not pick up by the present methods. It may not appear in the urine as an ordinary androgenic steroid. In the same way we cannot differentiate various types of adrenocortical tumors presenting different clinical pictures — all the way from masculinization to basophilism. In other words, although the laboratory has made tremendous advances it is by no means able to tell us in a given patient which gland is diseased.

CLINICAL DIAGNOSIS

Adrenal tumor, left (? type).

DR. LUDWIG'S DIAGNOSIS

Tumor of the left adrenal cortex.

ANATOMICAL DIAGNOSES

Carcinoma of adrenal cortex, left, with metastases to periaortic nodes.
Pulmonary embolism, right.
Bronchopneumonia.
Cardiac hypertrophy, hypertensive type.
Arteriosclerosis, moderate, aortic and coronary.
Hirsutism.

PATHOLOGICAL DISCUSSION

DR. BENJAMIN CASTLEMAN: This tumor weighed about 1000 gm. and showed histologically a characteristic adrenal-cell carcinoma. Much of the tumor was necrotic. Unfortunately the patient died a few days later from massive pulmonary embolism and bronchopneumonia. At autopsy we found in the region of the left adrenal gland a necrotic mass of tissue about 7 by 3 by 2 cm., which microscopically showed necrotic carcinoma. The other adrenal gland, although small, appeared normal. The regional periaortic lymph nodes were replaced by tumor. This is the fourth case of adrenal-cell carcinoma that we have seen here during the past five years. One patient had all the symptoms of Cushing's disease, and the negative response to irradiation of the pituitary gland was the only clue to the correct diagnosis.[1] The other two cases presented no endocrine changes. One was that of a young woman of thirty, who entered because of a mass in the left upper quadrant which was clinically diagnosed as splenomegaly.[2] The tumor was removed, and one year later a recurrence in the region of the transverse mesocolon was also removed. She gave birth to a baby during the next year, but when last seen, about a year and a half ago, an exploratory laparotomy revealed a huge inoperable recurrence in the left upper quadrant, with metastases to the periaortic lymph nodes. The other non-functioning tumor was removed from a forty-three-year-old man who entered the hospital with signs and symptoms of a Brodie's abscess of the tibia, which operation revealed to be a metastatic tumor consistent with one of adrenal origin.[3] The primary adrenal tumor was removed, and a Gritti-Stokes amputation of the leg performed. The patient was followed in the Out Patient Department and was doing well until two and a half years after operation, when a large, apparently recurrent, mass was discovered in the left upper quadrant. A course of x-ray treatment, totaling 2100 r, was given without any apparent change in the size of the mass. When last seen, two months ago, more than three years after operation, the mass was still present, but a chest plate was negative and the patient was feeling quite well.

REFERENCES

1. Case records of the Massachusetts General Hospital: Case 23011. *New Eng. J. Med.* 216:23-27, 1937.
2. *Idem:* Case 23121. *New Eng. J. Med.* 216:519-521, 1937.
3. *Idem:* Case 24101. *New Eng. J. Med.* 218:438-441, 1938.

CASE 26262

PRESENTATION OF CASE

A thirty-two-year-old white, African born, WPA worker was admitted to the hospital because he had been "seeing things" for three weeks.

The patient was brought to the hospital by his brother and a friend. The history obtained from them was vague and incomplete. It was stated that the patient had been a heavy drinker of alcoholic beverages for many years and had been treated for delirium tremens on two occasions. Three weeks before admission the patient had experienced what appeared to be visual hallucinations, as he saw "cats, dogs, people's faces" and so forth. He had been "irrational and out of his head." On occasions he talked normally, while immediately thereafter he changed to an entirely unrelated subject. His irrationality and confusion as well as hallucinations increased for a few days before admission. He was apparently "found" by the police of an outside community and was taken to the office of a physician, who made a diagnosis of acute alcoholism and stated that the patient had suffered from "exposure." He was then referred to this hospital for additional treatment. No further history was obtainable.

On admission the patient was irrational. He was restless, picked at the bed clothes, seemed tense and apprehensive and "jumped at a touch." There was no speech defect; he had visual hallucinations of "cigarettes" and "pieces of wood" in his hands, but denied others. He believed that he was in a club and that the date was 1930. He could not give his name, but gave his age and address correctly. He was able to perform simple calculations. His attention was held with difficulty, and recent memory was impaired. The speech was usually irrelevant and partly incoherent. He stated that he fell on the day before admission and struck his head, but gave no other history of trauma. He denied ever having taken drugs.

Physical examination revealed a restless, overactive, jumpy and delirious man. There were fine tremors of both hands, and he continually grasped at imaginary objects. The general examination showed no apparent head or body injuries. The tongue was dry and coated; the throat was red, but there were no localized areas of exudation. A postnasal drip was evident over an extremely dry, beefy-red pharynx. The upper teeth had been removed; the lower teeth were carious. There was a moderately loud systolic murmur over the apex of the heart. The blood pressure was normal. A few dry, crackling rales were heard on deep inspiration at the bases. Examination of the abdomen was negative. The liver was palpable 2.5 cm. below the costal margin in the right midclavicular line; its edge was not tender. A rectal examination was negative. The genitalia were negative except for the presence of genital warts on the shaft of the penis. There were abrasions over the elbows and scars over the lower legs, but otherwise the extremities were normal. Both pupils were dilated and fixed to light; the left was slightly larger than the right (the patient had received "drops" from a physician the day before, for examination of the eyegrounds). The remainder of the cranial nerves were normal. Both calf muscles were tender bilaterally. Sensation was normal. The abdominal, Hoffmann and cremasteric reflexes were absent. The knee jerk on the right was slightly more active than that on the left. The plantar reflexes were down. The Gordon and Oppenheim tests were negative. Cerebellar functions could not be tested. The neck was stiff, and there were bilateral Kernig signs.

The temperature was 100.2°F., the pulse 120, and the respirations 26.

Examination of the blood showed a red-cell count of 4,500,000 with 80 per cent hemoglobin (Tallqvist), and a white-cell count of 12,500 with 94 per cent polymorphonuclears; the smear was normal. The urine examination was negative save for the presence of a ++ albumin test. The blood Hinton test was positive, the blood Wassermann test weakly positive. The serum protein was 5.3 gm. per 100 cc., the serum nonprotein nitrogen 11 mg. The blood serum bromide examination was negative. A lumbar puncture showed an initial pressure equivalent to 200 mm. of water, with moderate cardiac and respiratory excursions. About 5 cc. of xanthochromic fluid was removed, with a final pressure of 105 mm. A cell count showed 300 lymphocytes, 100 red blood cells (crenated) and 15 polymorphonuclear cells per cubic millimeter. The Pandy test was ++; the total protein was 618 mg. per 100 cc.; the gold-sol test was 0001223321; the spinal-fluid Wassermann test was negative. The spinal-fluid sugar after another lumbar puncture was 36 mg. per 100 cc.

Roentgenograms of the chest showed no definite evidence of disease, although the skull showed a very questionable fracture line in the posterior parietal region. The findings, however, were said to have been not sufficient for diagnosis.

The patient remained in the hospital some fifty-odd hours, during which time he ran a continuous temperature above 102°F. He remained partly disoriented and required active sedation and restraint. He was given large doses of nicotinic acid and thiamin chloride, and fluids were

forced. In spite of all efforts of therapy, however, the patient expired early on the morning of the third hospital day. It was stated that his respirations suddenly became "rapid," and by the time a physician had arrived he was dead.

Differential Diagnosis

Dr. Merrill Moore*: I do not need to tell you that this is a difficult case. We might attempt in a logical way to rule out some of the more obvious possibilities. We know that this man was alcoholic. That is definitely stated by the informant and is probably the most obvious fact with which we have to deal, and it would be convenient if we could relate his final illness to his alcoholism. When we consider the causes of death in chronic alcoholism we recall that patients do die with no more specific diagnosis than delirium tremens, although there we are not very sure of the exact way in which death occurs — possibly with a general disturbance of body metabolism and disturbances in the cerebral circulation. We also find such patients dying of what is now beginning to be diagnosed clinically as Wernicke's disease, and there too the exact cause of death is not clear, although at autopsy the findings are usually more definite and more demonstrable than they are in delirium tremens. And we also know that alcoholism is a "smoke screen," that excessive drinking is often the result of psychological or social disturbances and that excessive drinking can and often does mask organic disorders of a serious nature, for the chronic alcoholic patient is very difficult to examine. He is usually unco-operative, he is often beclouded mentally, and unless one is accustomed to examine them, alcoholism can often mask neurological disturbances. The examination of the eyes is often difficult, and so are tests for muscle tone. We must remember that sometimes there can be absolutely no dependence on the examination, and that it is always possible for the examination to be inadequate. Therefore, before assuming that this patient died either of delirium tremens or of Wernicke's disease, we have to consider very carefully the very definite changes in the spinal fluid that are not entirely compatible with either diagnosis; accordingly, I should like to begin an attempt at a differential diagnosis in this case by saying that it does not seem to me that this patient died of delirium tremens or of Wernicke's disease.

The second point we must keep in mind in attempting to approach a diagnosis is that this patient does give a history of a fall. How reliable it is we do not know, but it is a part of the history that we cannot ignore, and I think we should not exclude it as a possible factor in his illness. We have to consider subdural or possibly intracerebral hemorrhage, and although the x-ray plate alone is not sufficient for diagnosis, it does bring up the question of a linear fracture. We know that alcoholic patients are very prone to have subdural hemorrhage; but if we assume that this patient did have one, we have to admit that the spinal-fluid findings in this case are unusual for such a diagnosis, although the pressure is rather high and there is an excess of white blood cells in the spinal fluid. In uncomplicated cases of subdural hemorrhage, we do not ordinarily see this except in conjunction with other or concomitant intracerebral hemorrhage due to trauma. If we try to tie up the whole history with the patient's alcoholism, we should think of subdural or intracerebral hemorrhage as a result of a fall the patient may have had while intoxicated, and consider that as one possible cause of death. But furthermore we have to consider the possibility as to whether this patient's terminal illness bore no relation at all to alcoholism, which is also quite possible. If this were so, what could the other disturbance be?

There is much in his illness to suggest that the terminal illness was not related to alcoholism and that he might have died, and probably did die, of some more or less acute febrile illness. If we are to admit that possibility, in spite of the weakly positive blood Wassermann test, the positive blood Hinton test and the negative spinal-fluid Wassermann test, we have to consider, first, tuberculous meningitis, since the spinal fluid contained 300 lymphocytes, 15 polymorphonuclear cells, a total protein of 618 mg. and a sugar of 36 mg. At that point we must remember that it is unfortunate that we do not have more spinal-fluid examinations because they would be extremely helpful in differentiating the various types of meningeal reaction that this patient may have undergone. They would be a great deal of help in making an accurate differential diagnosis.

Other possibilities could be an intracerebral hemorrhage, not related to trauma, which might have been located near one of the ventricles and which might thereby have caused softening of the ventricular wall and might have given rise to a meningeal cellular reaction in the spinal fluid. This could explain the high cell count and the high protein. This lesion might have occurred in one of the silent areas, in the frontal area or even in the basal cerebellar region. I do not believe that I can make any more definite diagnosis of this

*Associate in psychiatry, Harvard Medical School.

case without an autopsy. It is possible that one might be made if more careful and repeated clinical examinations had been possible and if more spinal-fluid examinations had been made. I can say very definitely that I do not believe that this man died of alcoholism alone and that there was some complicating factor in the nervous system, which might have been a subdural or intracerebral hemorrhage from trauma, an intracerebral hemorrhage without trauma or, more probably, an acute meningeal reaction of the tuberculous type. The negative spinal-fluid Wassermann is strongly indicative that it was not an acute syphilitic meningitis. The only recent case of subdural hemorrhage in an alcoholic patient that we have seen had spinal-fluid findings similar to those in this case but also had an intracerebral hemorrhage near a ventricle. We should not close the discussion of this case without mention of the remote possibility of brain abscess or new growth, although the history is rather acute in its onset for such a diagnosis and no focal area is suggested by the patient's history or examination.

DR. RICHARD SCHATZKI: There are two lateral portable films of the skull apparently taken a few hours before he succumbed, when he was in a very unco-operative state. There is no reason to suppose they would show anything but the grossest pathology. A question might be raised as to whether it is justifiable to subject a patient to examination of the skull when so little is to be expected; the procedure is at times not without danger to the patient.

DR. MOORE: Was another Wassermann test done?

DR. MALLORY: Not on the spinal fluid. The blood Hinton was checked.

DR. JAMES B. AYER: I do not remember this case. I think Dr. Moore is on safe grounds when he says there is something besides alcoholism. As I read the case it seemed to me there must have been hemorrhage, and I should rather like to place it at the base, probably a meningeal hemorrhage at the base. With fractures at the base of the skull we see that fatal type of hemorrhage which may seep into the basal cisternae, may give a high spinal-fluid protein and a rhinorrhea and does not show by x-ray except rarely. With the high protein and the increased cells, I also wonder if infection from the nasopharynx has not occurred.

DR. MOORE: You interpret the postnasal drip as the result of a basal fracture?

DR. AYER: It could be.

DR. MOORE: Yes, it could be.

CLINICAL DIAGNOSES

Delirium tremens.
Meningitis?
Intracranial hemorrhage?

DR. MOORE'S DIAGNOSIS

Tuberculous meningitis.

ANATOMICAL DIAGNOSIS

Tuberculous meningitis.
Miliary tuberculosis.

PATHOLOGICAL DISCUSSION

DR. MALLORY: There was no fracture of the skull, and no hemorrhage was found. The meninges at the base were quite cloudy, and there were some suggestive tubercles on gross examination. On microscopic examination there was quite clearly a tuberculous meningitis. Miliary tubercles were found in considerable numbers throughout the viscera, and the meningitis was unquestionably secondary to a generalized miliary tuberculosis.

The New England
Journal of Medicine

Formerly the
Boston Medical and Surgical Journal
Established in 1828

OWNED BY THE MASSACHUSETTS MEDICAL SOCIETY AND PUBLISHED UNDER THE JURISDICTION OF THE COMMITTEE ON PUBLICATIONS

Official Organ of
THE MASSACHUSETTS MEDICAL SOCIETY
THE NEW HAMPSHIRE MEDICAL SOCIETY
THE VERMONT STATE MEDICAL SOCIETY

EDITORIAL BOARD

Joseph Garland, M.D.
William B. Breed, M.D.
George R. Minot, M.D.
Frank H. Lahey, M.D.
Shields Warren, M.D.
George L. Tobey, Jr., M.D.
C. Guy Lane, M.D.
William A. Rogers, M.D.
John P. Sutherland, M.D.
Stephen Rushmore, M.D.
Hans Zinsser, M.D.
Henry R. Viets, M.D.
Robert M. Green, M.D.
Charles C. Lund, M.D.
John F. Fulton, M.D.
A. Warren Stearns, M.D.
Dwight O'Hara, M.D.

ASSOCIATE EDITORS

Thomas H. Lanman, M.D.
Donald Munro, M.D.
Henry Jackson, Jr., M.D.

Walter P. Bowers, M.D., EDITOR EMERITUS
Robert N. Nye, M.D., MANAGING EDITOR
Clara D. Davies, ASSISTANT EDITOR

SUBSCRIPTION TERMS: $6.00 per year in advance, postage paid, for the United States; Canada, $7.04 per year; $8.52 per year for all foreign countries belonging to the Postal Union.

MATERIAL for early publication should be received not later than noon on Saturday.

THE JOURNAL does not hold itself responsible for statements made by any contributor.

COMMUNICATIONS should be addressed to the *New England Journal of Medicine*, 8 Fenway, Boston, Massachusetts.

CONGRATULATIONS

THE *Journal* extends congratulations to Dr. Frank Howard Lahey, of Boston, because of his designation as president-elect of the American Medical Association, and to the House of Delegates because of the wisdom of its choice.

The American Medical Association was organized in 1847, and during the first fifty years, six New England physicians — four from Massachusetts and two from Connecticut — served as presidents. Of the former, the first was John Collins Warren, of Boston, who was elected in 1849. David Humphrey Storer, of Boston, was chosen in 1866; Henry Ingersoll Bowditch, of Boston, in 1877; and Henry Orlando Marcy, of Cambridge, in 1892. To serve during the next forty-five years, only one New England representative was selected, — Herbert Leslie Burrell, of Boston, — and he held office in 1908, thirty-two years ago.

In view of the prominence of Boston as a medical center, in view of the responsible positions held by its physicians in the various societies devoted to medicine, surgery and the medical specialties and in view of the many excellent physicians scattered throughout New England, it has been difficult to understand why only one physician from this section of the country had been elected to the presidency of the American Medical Association in forty-eight years. Perhaps Yankees, in general, are uncompanionable, and perhaps Bostonians, in particular, are a bit complacent. So far as Dr. Lahey is concerned, his innumerable friends all over the United States refute the former, and the views expressed in his published papers and unpublished speeches negate the latter. This acquaintanceship and this broadmindedness, together with his well-recognized ability as a surgeon, as an administrator and as a teacher of physicians, make the choice of the House of Delegates a happy one.

PROLONGED RESIDENCIES: THEIR EFFECT ON THE PRACTICE OF MEDICINE

THE effect of prolonged residencies on medical education and on hospitals has been considered in the June 13 and June 20 issues of the *Journal*. The third and final problem — that of their effect on the practice of medicine — presents obvious difficulties; such an effect or effects will not be experienced immediately, and it is hazardous in the extreme to attempt to predict them. The effort is not without interest, however, and some of the premises, at any rate, may be agreed on regardless of whether or not the conclusions seem acceptable.

The product of the new system will certainly be a much more highly trained man than the majority of his predecessors. He will have had an intensive clinical experience with hospital medicine but not the slightest experience with practice. Five years of semi-monastic institutional life with consultants, nurses, laboratories, dietitians and social-service workers at his beck and call are hardly the best of backgrounds for adaptation to an individ-

ualistic, competitive medical practice. Having passed the age of thirty, he finds himself cast loose into the community without a contact that might reasonably bring a patient to his office. His erstwhile classmate in college, who sensibly decided to sell bonds, is seriously concerned about the preparatory school to which the son should be sent. It is only reasonable to suppose that any offer of immediate financial security will prove almost irresistible to him, and that the numbers of full-time salaried specialists — and by the newer definitions this will certainly mean surgeons and probably internists — will be increased by his accession. Accustomed for so many years to constant consultative association with other specialists, he will also start with a strong tendency toward group medicine rather than toward individual practice.

In line with this, and as another by-product of the new system, and of the boards of certification, which have done so much to bring it into effect, there will be an increased sharpness in the division between practitioner and specialist. As adequately trained men become more numerous and as the criteria of such training become recognized more generally it will be increasingly difficult for men to shift from the first status to the second. To a large extent this will be a safeguard to the members of the community, who will thus be protected from untrained, self-styled "specialists." There are potential liabilities, however. Even an inadequate surgeon or roentgenologist is far better in an emergency than no surgeon or roentgenologist at all. It is to be hoped that requirements and regulations preceding certification will not be pushed to such an extreme that small communities which cannot support a variety of fully qualified specialists will be deprived of essential services.

Furthermore, it is most important that the specifications of training shall not become too rigid. There is gentle irony in the fact that men who to a large extent were self-taught believe that their successors cannot achieve an education in the same manner. Instruction is a short cut to knowledge: properly imparted and assimilated it will greatly accelerate the acquisition of knowledge and will prevent many a needless mistake, but all the instruction in the world will never eliminate the need for self-education. It is fair enough to demand proof of qualification, but the gateway must never be closed to the man who chooses the unconventional and original approach. By present standards Harvey Cushing's training in brain surgery was shockingly inadequate!

MEDICAL EPONYM

Chadwick's Sign

James R. Chadwick (1844–1905), of Boston, made no claim to be the discoverer of the diagnostic value of the bluish discoloration of the vaginal mucous membrane which occurs in pregnancy, but in an article appearing in the *Transactions of the American Gynecological Society* (**11**:399–415, 1887), entitled "The Value of the Bluish Coloration of the Vaginal Entrance as a Sign of Pregnancy," after referring to previous observers of the phenomenon, he states:

> In scrutinizing the color of this part in a large number of women, I early discovered that, while in the majority the bluish tinge appeared over the whole vaginal entrance, there was a fair proportion in which the violet tint was confined to the anterior wall of the vagina, just below the urinary meatus, whence it shaded off into the normal pink color laterally. This, when distinctly perceptible, I soon found to be, in my practice, an absolutely sure sign of pregnancy. There were, furthermore, a very few in whom the blue tint was universal, but more accentuated on the posterior wall of the vaginal entrance, which I found was valueless as a sign of pregnancy, unless the color was quite deep. The recognition of this peculiar localization of the blue tint on the anterior wall as a sure sign of pregnancy I feel is the most important new point in this communication.

R.W.B.

MASSACHUSETTS MEDICAL SOCIETY

SECTION OF OBSTETRICS AND GYNECOLOGY*

Raymond S. Titus, M.D., *Secretary*
330 Dartmouth Street
Boston

Pyelitis of Pregnancy

Beginning with the May 2, 1940, issue, pyelitis of pregnancy has been discussed in the *Journal*. The cases of former years emphasized symptomatic treatment: rest in bed, urinary antiseptics

*A series of selected case histories by members of the section will be published weekly. Comments and questions by subscribers are solicited and will be discussed by members of the section.

and forced feedings. The prognosis of the immediate attack was always good. The disease might well recur during pregnancy, but the opinion was held that after delivery the kidney infection spontaneously cleared up with no subsequent damage. We know that this is not always the case — that pyelitis of pregnancy is very frequently followed by permanent kidney damage. As cystoscopy and kidney lavage became common practices in urology, their use in diagnosing and treating renal disease during pregnancy naturally followed. Cases have been presented showing distinct improvement following this form of treatment; the acute attacks subsided much more quickly than they did under symptomatic treatment, and subsequent exacerbations were not so common.

The present era of chemotherapy includes the field of kidney infection. Mild cases have responded remarkably well to this type of therapy, and such results may lead the medical profession to disregard the value of intravenous pyelograms, cystoscopy and kidney lavage, occasionally to the detriment of the individual patient. All cases of pyelitis of pregnancy which do not respond to supportive treatment should be seen by competent urologists before chemotherapy is instituted. Sulfanilamide and its allied compounds are not foolproof drugs, and their administration should never be undertaken by one who is not versed in their use. The patient's health will best be served by an appreciation of this fact by general practitioners and by obstetricians.

In the series presented no cases have been reported in which there was the need for interrupting pregnancy because of pyelitis; however, twenty or twenty-five years ago this was not uncommon. Early diagnosis, early consultation, kidney lavage, if necessary, and chemotherapy should make this procedure entirely unnecessary except in cases already presenting irreparable kidney damage. It is also possible that chemotherapy may reduce very materially the permanent kidney damage that we now know so frequently followed attacks of pyelitis during pregnancy.

The subsequent series of cases will deal with pneumonia as a complication of pregnancy.

DEATHS

HAYES — WILLIAM F. HAYES, M.D., of Beverly, died April 4. He was in his fifty-ninth year.

Dr. Hayes received his degree from Tufts College Medical School in 1909 and was a member of the Massachusetts Medical Society and the American Medical Association.

PEASE — EDWARD A. PEASE, M.D., of Pasadena, California, died June 19. He was in his seventy-sixth year.

Dr. Pease received his degree from Harvard Medical School in 1892 and was a fellow of the Massachusetts Medical Society and the American Medical Association.

RUGGLES — EDWIN P. RUGGLES, M.D., of Dorchester, died June 19. He was in his sixty-eighth year.

Born in Milton, he received his education at Springfield College and the University of Iowa, and obtained his degree from Boston University School of Medicine in 1900. He was director of physical education at the University of Iowa for two years, and in 1903 became a member of the staff of the Massachusetts Memorial Hospitals.

Dr. Ruggles was professor emeritus of obstetrics at Boston University School of Medicine and had served as chief of the obstetric service at the Massachusetts Memorial Hospitals.

Among his affiliations were fellowships in the Massachusetts Medical Society and the American Medical Association, and memberships in the New England Obstetrical and Gynecological Society and the American College of Surgeons.

His widow and a daughter survive him.

MISCELLANY

RÉSUMÉ OF COMMUNICABLE DISEASES IN MASSACHUSETTS FOR MAY, 1940

DISEASES	MAY 1940	MAY 1939	FIVE-YEAR AVERAGE*
Anterior poliomyelitis	1	0	4
Chicken pox	1207	742	1091
Diphtheria	15	21	22
Dog bite	1422	1414	1259
Dysentery, bacillary	15	5	6
German measles	109	91	2251
Gonorrhea	313	358	435
Lobar pneumonia	386	355	423
Measles	4060	4917	3415
Meningococcus meningitis	3	6	16
Mumps	943	679	993
Paratyphoid B fever	22	0	20
Scarlet fever	672	731	1027
Syphilis	518	462	470
Tuberculosis, pulmonary	395	239	271
Tuberculosis, other forms	31	30	29
Typhoid fever	17	2	6
Undulant fever	8	4	3
Whooping cough	756	635	634

*Based on figures for preceding five years.

RARE DISEASES

Anterior poliomyelitis was reported from Chicopee, 1; total, 1.

Diphtheria was reported from: Boston, 2; Fall River, 3; Framingham, 1; Methuen, 2; North Andover, 1; Worcester, 6; total, 15.

Dysentery, bacillary, was reported from: Attleboro, 3; Boston, 4; Deerfield, 1; Lowell, 6; Milton, 1; total, 15.

Infectious encephalitis was reported from: Beverly, 1; Danvers, 1; total, 2.

Meningococcus meningitis was reported from: Beverly, 1; Lynn, 1; Reading, 1; total, 3.

Paratyphoid B fever was reported from: Arlington, 1; Bernardston, 1; Boston, 6; Concord, 1; Haverhill, 2; Lynn, 1; Medford, 2; Newton, 3; Pittsfield, 3; Quincy, 1; Worcester, 1; total, 22.

Pfeiffer bacillus meningitis was reported from: Attleboro, 1; New Bedford, 2; total, 3.

Septic sore throat was reported from: Amesbury, 1; Arlington, 1; Belmont, 1; Boston, 5; Fitchburg, 1; Foxboro, 1; Gardner, 1; Greenfield, 1; Leominster, 1; Lynn, 2;

Milford, 1; Quincy, 2; Weymouth, 1; Winchester, 2; Wrentham, 1; total, 22.

Tetanus was reported from: Saugus, 1; Wareham, 1; total, 2.

Trachoma was reported from: Everett, 1; Wakefield, 1; total, 2.

Trichinosis was reported from: Greenfield, 2; Hadley, 1; North Andover, 2; total, 5.

Typhoid fever was reported from: Arlington, 1; Middleboro, 1; New Bedford, 1; North Attleboro, 1; Norton, 4; Provincetown, 1; Somerville, 6; South Hadley, 1; Taunton, 1; total, 17.

Undulant fever was reported from: Adams, 1; Danvers, 1; Middleboro, 1; Milton, 1; Southbridge, 1; Swampscott, 1; West Boylston, 2; total, 8.

Typhoid fever had its highest May incidence since 1931. A recent outbreak in the Metropolitan area is responsible for the greater part of this sudden increase.

The May incidence of undulant fever is higher than it has been since 1930. The reported cases are scattered throughout the State.

A recent outbreak of paratyphoid B fever in the Metropolitan area accounts for a sudden sharp rise in the reported incidence of this disease.

The reported incidence of dog bite is reaching its seasonal peak.

The incidences of chicken pox and measles are reported at levels slightly above the five-year average.

Anterior poliomyelitis and German measles are reported well below the five-year average.

Gonorrhea, lobar pneumonia, meningococcus meningitis, mumps, bacillary dysentery, scarlet fever and tuberculosis are reported at expected levels.

HARVARD MEDICAL SCHOOL

Selection of the three outstanding candidates for admission to the Harvard Medical School next fall as recipients of national scholarships offered by the school under Harvard University's "long-term" scholarship policy was recently announced. The winners are James S. Clarke, of La Grange, Illinois, A.B. Harvard '40 (Daniel Fiske Jones National Scholarship); Martin E. Flipse, of Douglaston, Long Island, New York, A.B. Hope College '40 (Edward S. Harkness National Scholarship); and Winsor C. Schmidt, of Rye, New York, Sheffield Scientific School, Yale (Harvard Medical School National Scholarship).

This is the fourth year of the medical school's national-scholarship plan, which is similar to that introduced by President James B. Conant in Harvard College in 1934, and subsequently adopted also by the Graduate School of Arts and Sciences, the Graduate School of Design, and the Graduate School of Business Administration.

In addition, medical-school scholarships totaling $1300, for study during the next academic year, were awarded as follows: Matthew and Mary E. Bartlett Scholarship to James P. Dixon, Jr., of Yellow Springs, Ohio, S.B. Antioch '39; Abraham A. Watson Scholarship to Lytt I. Gardner, of Reidsville, North Carolina, A.M. University of North Carolina '40; and Isaac Sweetzer Scholarship to Frank E. Trobaugh, Jr., of West Frankfort, Illinois, A.B. University of Illinois '40.

TUFTS COLLEGE MEDICAL SCHOOL

Ninety-seven students of the Tufts College Medical School received medical degrees at the college's eighty-fourth commencement exercises on Monday, June 17.

The Annual Alumni Award, a sphygmomanometer of special construction, given to the graduate who is considered to have made the most progress in the four-year course at the medical school, was won by John D. Rice, of Worcester, who received his premedical training at Bowdoin College. The Phi Delta Epsilon Gold Medal, for proficiency in the study of anatomy, was given to Fred W. Thyng, of Shapleigh, Maine, who also received his premedical training at Bowdoin College. The name of the winner of the latter is inscribed each year on a bronze tablet in the medical school. Dr. Thyng received his degree cum laude. Others who received their degrees cum laude were: Edward N. Cartnick, A.B. Harvard, of Clifton, New Jersey; Robert A. Hays, A.B. Boston College, of Waltham; Harvey W. Katz, B.S. Tufts College, of Everett; Leonard M. Klein, A.B. Harvard, of Roxbury; Emil J. Koenig, Jr., B.S. Massachusetts State College, of Jefferson; Abraham Pollen, B.S. Tufts College, Chelsea; Stanley L. R. Robbins, B.S. Massachusetts Institute of Technology, of Brookline; Gertrude A. Rogers, A.B. Radcliffe, of Dorchester.

MIDDLESEX UNIVERSITY SCHOOL OF MEDICINE

The trustees of Middlesex University announce the appointment of Dr. Augustus Riley, of Boston, as dean of the medical school. Dr. Riley was born in Alabama in 1879, received his baccalaureate degree in arts from Oberlin College, and his medical degree from Harvard in 1907. After graduation he served an internship at the Long Island Hospital, Boston, and a surgical internship at the Massachusetts General Hospital. He is a member of the American Urological Association and a fellow of the American College of Surgeons. He is assistant professor of genitourinary surgery at the Harvard Medical School, where he has taught since 1911, and is visiting surgeon for urology at the Boston City Hospital. Dr. Riley will take office immediately.

MASSACHUSETTS SOCIETY FOR RESEARCH IN PSYCHIATRY

On May 2, 1940, the Massachusetts Society for Research in Psychiatry was officially organized and held its first meeting.

The object of the society is to stimulate research in psychiatric medicine and its allied sciences in the psychiatric institutions of the Commonwealth. Members are made up of active and associate members, the active membership being limited to those who have completed or presented before a recognized scientific society, or published in a recognized scientific journal, results of research work which they have done within the last five years. This active membership will cease after more than three years have elapsed without production of original work, the member becoming an associate member. The associate members are selected from those having a background and training that renders them suitably qualified to become research workers, and from those who are participating in research work.

The meetings are to be held six times a year at the various hospitals in the Commonwealth engaged in neuropsychiatric work. They are to be devoted to symposiums and to informal discussions of projects, methods, technics and demonstrations of research work actively engaged in or under discussion.

The following officers were elected for the coming year: president, Dr. William Malamud; vice-president, Dr. Paul Yakovlev; secretary-treasurer, Dr. Kenneth J. Tillotson.

CORRESPONDENCE

MILITARY PREPAREDNESS PROGRAM

To qualified physicians of Massachusetts the National Guard (26th Division) offers an opportunity to participate in the military preparedness program.

The 101st Medical Regiment and the medical detachments of the various combat units of the 26th Division are in the process of being expanded so that the advantage of early consideration of military service is obvious, both from the standpoint of choice of service and that of seniority.

All who are interested are urged to contact one of the officers of the Division Surgeon's Office, who will gladly discuss the various units and furnish information regarding qualifications, duties, pay and allowances. This office is located in the South Armory, Irvington Street, Boston, and is open Tuesday and Friday evenings from eight until ten o'clock.

Act now! The National Guard needs qualified physicians, and the latter need the practical experience which only service with troops can afford.

KARL R. BAILEY,
Colonel, M. C., Mass. N. G.,
Division Surgeon.

REPORTS OF MEETINGS

GREATER BOSTON MEDICAL SOCIETY

A regular meeting of the Greater Boston Medical Society was held at the Beth Israel Hospital on March 5, with Dr. Max Ritvo presiding.

Dr. William B. Castle spoke on "Blood Dyscrasias: An aspect of general medicine." The importance of a complete history and accurate physical examination as well as blood studies in these conditions was stressed by Dr. Castle. The limitations of bone-marrow biopsy in the diagnosis of anemias were contrasted with the greater definitiveness of lymph-node biopsy in differentiating the lymphoma group.

The blood dyscrasias were divided into groups depending on what can be expected from their treatment. Among preventable diseases Dr. Castle listed the hypochromic anemia of pregnancy and that associated with rapid growth in childhood, aplastic anemia and atypical leukemia due to industrial exposure to the cyclic compounds, and hemorrhagic disease of the newborn. Those in which cure or great benefit may be expected from proper therapy included congenital hemolytic jaundice, pernicious anemia without neurologic manifestations, "idiopathic" hypochromic anemia and hemorrhagic disease of the newborn. The third group consisted of conditions where treatment is of some help, such as polycythemia vera, chronic leukemia, idiopathic thrombopenic purpura, lymphoma, pernicious anemia with combined system disease, and malignancy complicated by treatable anemia.

The value of vitamin K in preventing as well as treating hemorrhagic disease of the newborn was emphasized. So-called idiopathic hypochromic anemia was attributed in most cases to apparent or occult blood loss and so should be attacked by discovering and stopping this loss and giving adequate iron therapy. Dr. Castle spoke of bleeding, with or without a low-iron diet, in order to produce the iron lack necessary to control the overactive blood production of polycythemia vera. The value of x-ray therapy in chronic lymphatic leukemia and the lymphomas was considered to lie in the increased duration of effective and comfortable life rather than in any prolongation thereof, except when local expanding lesions threaten vital structures. The neurologic manifestations of primary anemia can at least be arrested with adequate liver therapy. Finally, many patients with malignant disease can be made much more comfortable by caring for coincidental anemia.

Among the conditions which may be improperly diagnosed in the presence of blood dyscrasias, Dr. Castle cited heart disease, gastrointestinal disturbances, nephritis, neurologic lesions and liver disease. Unnecessary disability or dangerous procedures might result from false diagnosis. The speaker warned against splenectomy unless congenital hemolytic jaundice or idiopathic thrombopenic purpura has been surely diagnosed, against roentgen therapy in the possible presence of aplastic anemia or nonleukemic myelosis and against ill-advised surgery in untreated scurvy, hemophilia or vitamin K deficiency. A mistaken diagnosis may lead to an erroneous prognosis. Thus a patient given a hopeless prognosis from supposed leukemia may live indefinitely to taunt the doctor after recovery from his infectious mononucleosis. The converse may also occur. Proof of poor diagnosis was illustrated by statistics on pernicious anemia, where in a series of 100 patients the average delay from the onset of definite symptoms to the making of the correct diagnosis was almost a year and a half. In those whose original symptoms were alimentary, the diagnosis was not made on the average for almost three years.

The anemias were divided into two large groups, those in which the demand for red cells exceeds the supply and where the bone marrow is physiologically active, and those in which the supply is deficient for even a normal demand and the marrow activity is depressed. The first group includes the two large subgroups of acute blood loss and increased blood destruction. The latter subdivision is made up of extrinsic causes such as chemicals and infections, and intrinsic ones such as abnormal erythrocytes or abnormal plasma. The large division exhibiting poor hematopoiesis includes nutritional, hormonal, toxic (benzene), physical (x-ray), mechanical (malignancy) and idiopathic causes. In those anemias caused by encroachment of malignant tissue on the marrow there is a false activity mirrored in the peripheral blood as a result of overworking of the reduced amount of effective hematopoietic tissue.

Dr. Castle went on to discuss criteria for the diagnosis of certain of the blood dyscrasias, emphasizing the importance of at least a hemoglobin determination and a blood film in every patient. These will prevent gross oversight and will serve to indicate the need for more extensive blood studies. Hypochromic anemia can be diagnosed by blood examination alone, for the only possible similarity appears in chronic infection. Congenital hemolytic jaundice is characterized by a significant increase of the erythrocyte fragility due to the predominance of spherocytes. In most instances, however, the diagnosis cannot be made without, in addition, a careful history and physical examination. In pernicious anemia, these were considered particularly important, for the symptoms may follow the characteristic symptom pattern of stomatitis and neural manifestations. It was pointed out that such symptoms may occur with only minimal anemia.

Dr. Castle briefly discussed the two theories as to the pathogenesis of pernicious anemia. One holds that the liver extract necessary for erythrocyte maturation is formed

by the action of the gastric secretions on some food substance, probably a portion of the vitamin B complex. Rhoads, on the other hand, believes there is a toxin which causes hemolysis only in the presence of malnutrition. In describing the current method of treating pernicious anemia, Dr. Castle emphasized that the U.S.P. unit of liver extract used is based on a satisfactory hematopoietic response and does not necessarily indicate the therapeutic effectiveness on gastrointestinal or central-nervous-system manifestations of the disease. The speaker advocated the use of 5 to 10 U.S.P. units intramuscularly on each of the first two or three days, and a minimal maintenance dose of 15 units intramuscularly each week for about three months, at which time it may be halved if the clinical and hematological condition is satisfactory. The oral administration of liver extract was considered undesirable, especially in patients with severe anemia or combined system disease, because of the possible failure of a certain proportion of patients to respond.

Dr. Castle then considered the hypochromic anemia of iron deficiency, which is found especially during the period of rapid growth at puberty, in pregnancy and in bleeding of all sorts. The considerable loss of iron during the menstrual cycle of women was stressed as an important cause of so-called "idiopathic" hypochromic anemia. Studies of the effect of maternal anemia on the infant showed that there is no relation to the infant's level at birth, but that children of anemic mothers are prone to the development of anemia at about one year. The indiscriminate use of expensive liver extract in undiagnosed anemias was deprecated because of the possibility of confusion as to what brought about recovery and also because it might commit the patient to an unnecessary life of continuous liver therapy.

There was a brief consideration of the significance of certain findings on blood examination. Leukopenia might be found in influenza, measles, typhoid fever, undulant fever, malaria, catarrhal jaundice, the Felty syndrome, agranulocytosis, aleukemic leukemia, Banti's syndrome, aplastic anemia, pernicious anemia and cirrhosis of the liver. It was emphasized that in agranulocytosis there is usually little evidence of depression of the red blood cells and platelets, which are, however, affected in aplastic anemia and aleukemic leukemia.

Among common conditions causing lymphocytosis were cited pertussis, measles, rickets, tuberculosis, infectious mononucleosis and the lymphatic leukemias. The latter two diseases were particularly stressed, and the diagnostic value of the heterophile agglutination test in mononucleosis was emphasized. The complexities of the clinical manifestations and terminology of the leukemias and lymphomas were explained by an analogy to the different manifestations of staphylococcal infections: furuncle, osteomyelitis, septicemia.

Dr. Castle concluded with a brief résumé of hemorrhagic disease. This was divided into vascular, platelet and coagulation defects. Conditions of the first group were infections, arteriosclerosis, congenital thrombasthenia, nutritional deficiencies (vitamin C) and allergic diseases, such as Henoch's purpura. Thrombopenic purpura was subdivided into symptomatic, which may occur in aplastic or myelophthisic anemia or leukemia, and "essential," which includes allergy to drugs and the idiopathic form. In the latter there is usually no decrease of leukocytes and erythrocytes; the bleeding time is prolonged, the clotting time normal, and the tourniquet test positive, whereas the platelets are reduced. Splenectomy is the only, but not a regularly effective, treatment for idiopathic thrombopenic purpura.

The discussion was opened by Dr. M. B. Strauss, who stated that more than 12 patients have been seen at the Boston City Hospital in the past two years who were unnecessarily under liver therapy for a mistaken diagnosis of pernicious anemia. It was claimed that repeated doses of liver extract intramuscularly at intervals of not more than four weeks are preferable to single large doses at less frequent intervals.

Dr. Henry Jackson, Jr., reiterated the importance of studying the patient as a whole rather than merely the blood. He stated that a definite sequence of events occurs in bone-marrow failure and may account for the variable peripheral blood picture during the course of a disease. Anemia can take place only with time; thus it is gradual in such conditions as leukemia. Dr. Jackson cited the importance of distinguishing myeloid metaplasia from chronic myelogenous leukemia and hemolytic jaundice, either of which it may simulate. X-ray therapy in the first instance or splenectomy in the second would undoubtedly prove fatal if the wrong diagnosis were made.

Dr. B. M. Jacobson advocated the routine use of Hayem's rather than Gower's solution for red-blood-cell counts, for in this way one may note a precipitation of the mercury bichloride in the presence of an elevated serum globulin, such as is found in liver disease and multiple myeloma. He reminded the audience that although nutritional anemias are decreasing, the advent of new drugs has offset this improvement by producing other kinds of anemia.

Dr. Wyman Richardson discussed "splenic anemia," a term loosely used in anemias associated with splenomegaly. Splenomegaly is known to have some relation to leukopenia, but Dr. Richardson doubts that the same can be said for anemia. He believes that there is always hemorrhage to account for hypochromic anemia and that thrombosis of the splenic vein may cause this. Splenectomy was not advocated.

Dr. William Dameshek emphasized the importance of interpreting blood findings on a physiological basis. He mentioned the rare cases of hemolytic anemia with jaundice but no bilirubinuria which may be benefited by splenectomy. Dr. Dameshek stated that splenectomy does affect the bone marrow in purpura, for there seem to be abundant megakaryocytes but no platelet formation.

BOSTON ORTHOPEDIC CLUB

A regular meeting of the Boston Orthopedic Club was held at the Boston Medical Library on March 11, with Dr. Armin Klein presiding.

The speaker of the evening was Dr. Warfield M. Firor, who spoke on "Recent Experimental and Clinical Observations on Tetanus." The first part of the discussion was devoted to recent experiments performed at the Johns Hopkins University School of Medicine in an attempt to disprove the neural transmission of tetanus toxin and to determine the true mechanism of the pathogenesis of the resultant disease.

The original work was initiated by Abel, who by careful technic showed that local tetanus does not result from sciatic injection of the toxin, and that antitoxin injected into the nerve proximal to the toxin does not prevent local tetanus unless it is allowed to leak out into the surrounding tissues. It is believed that the fallacy of Meyer's experiments, which seemed to indicate that tetanus toxin is transmitted by peripheral nerves, consisted in allowing leakage from the nerve. Abel was also able to perfect a method for producing local tetanus which lasted for three months before the muscle returned to normal. Multiple intramuscular injections totaling only one two-hundredths

of a lethal dose of the toxin resulted in an unyielding rigidity that was considered a true peripheral manifestation of the disease, the site of action being the neuromuscular end-organs.

In order to prove that both rigidity and convulsive spasms result from the action of tetanus toxin on the anterior-horn cells of the cord, Meyer injected toxin directly into the spinal cord. He obtained an extremely painful form of the disease which he called tetanus dolorosus. In repeating these experiments Dr. Firor was able to avoid this painful complication by rotating the cord before injecting the toxin into the anterior horns. These injections produced tactile reflex tetanus without inducing any muscular rigidity. With tactile reflex tetanus the slightest sensory stimulus initiates a series of clonic spasms that last for two or three minutes.

Although this seemed to be a central form of the disease without true peripheral manifestations, the puzzling fact was that the animals all died, even when only a small fraction of an ordinary lethal dose was employed. Various hypotheses were suggested to account for this lethal phenomenon. That a metabolic poison from the convulsions was not responsible was proved by separating the cauda equina from the spinal cord and then injecting the stump so that peripheral contractions did not occur, and yet death occurred. To disprove the ascent of the toxin in the cord a sizable section of the cord was resected and the toxin put in the distal portion, but still the animals died. That the course is not affected by the site of injection was shown by the presence of a similar incubation period of well-being, even when the toxin was introduced into the medulla. That multiplication within the cord does not explain the peculiar lethal effect was proved by transplantation of the injected segment. Finally antitoxin was administered intravenously prior to intraspinous injection of the toxin to rule out multiplication in the blood stream, but such animals succumbed with an excess of antitoxin in the circulating blood.

Control experiments consisted of the similar injection of other toxins, none of which caused death except diphtheria toxin, and this was due to extensive necrosis of the cord; the injection of tetanus toxin into other organs without the potentiation found in the central nervous system; and the injection of tetanus toxin into the spinal cord of other species that showed the same phenomenon to varying degrees, depending upon their sensitivity. It was found that cats require nine hundred times as much toxin injected intravenously as do guinea pigs, but when given intraspinously one guinea-pig lethal dose per kilogram causes death in all the species tested; therefore, it was concluded that resistance is proportional to the presence of some mechanism preventing the toxin from reaching the sensitive nervous tissue. These observations led to the hypothesis that tetanus toxin is fixed on reaching the central nervous system, where it is either altered or liberates a new substance which is responsible for the lethal effect and is not amenable to antitoxin.

By using cross-circulated dogs it was determined that a recipient presaturated with antitoxin lived, while the donor treated with toxin died if the mixing of the blood was done before symptoms began in the donor. But if the crossing was carried out subsequent to the onset of symptoms, the recipient and the donor died at about the same time and with similar symptoms despite the use of antitoxin beforehand in the recipient; consequently, this seemed further evidence that something other than tetanus toxin was effective in the recipient. That the quantity of toxin administered is important was demonstrated by experiments which showed that a third of a lethal dose given intravenously caused no symptoms, but a half to three quarters resulted in characteristic symptoms.

An interesting practical observation was that barbiturates and other commonly employed respiratory depressants appeared to affect toxic animals more deleteriously than normal ones. It was considered that this was a synergistic action between these drugs and the tetanus toxin that kills essentially by respiratory inhibition. The suggestion was advanced, therefore, that such medication is not rational for the control of the convulsions of tetanus.

In regard to the efficacy of antitoxin, it was stated that this can save life if administered before injury or before symptoms develop if the dose is huge, but never after symptoms have become established. It seems that after one lethal dose of tetanus toxin is fixed, incubated and altered in the central nervous system, no amount of antitoxin can be lifesaving. The amount of antitoxin necessary in any case was held to depend on the route of entry of the toxin, for it was found that the intramuscular site of toxin injection requires ten times and the intraspinous ten thousand times the dose of intravenous antitoxin. Dr. Firor stated that preliminary animal experiments indicate that intrathecal administration of antitoxin may be more beneficial than is the intravenous route.

As a result of these experiments the theory has been postulated that the tetanus organism develops only in the presence of already existing infection, and that the toxin then diffuses through the tissue fluids to reach the local neuromuscular end-organs and produce local tetanus; thence it reaches the blood stream and a small amount is fixed on reaching the central nervous system, but this produces no symptoms. There the toxin either is altered or alters the tissue, and tactile reflex tetanus then appears. A certain amount of this changed material reaches the systemic circulation and death results from respiratory failure. The outcome, therefore, is determined by the amount of tetanus toxin reaching the central nervous system, where it is fixed and altered.

Dr. Firor then discussed the treatment of human tetanus in the light of this work. The site of injury is determined, if possible, and infiltrated with antitoxin an hour before doing a thorough débridement. This precautionary delay was considered advisable in order to prevent local tetanus from squeezing out the toxin during manipulation. Fifty thousand units of antitoxin are administered intravenously, for this has been found an adequate dose against any conceivable infection. The fluid balance is carefully maintained, and the choice of sedatives is paraldehyde, chloral, or ether in oil by rectum.

Prophylaxis is now concerned with active as well as passive immunization, it was pointed out. Passive immunization can be conferred by 1500 units of antitoxin, which will result in a titer of 0.1 unit of antitoxin per cubic centimeter of blood for the succeeding four or five days. Active immunity as produced with toxoid has proved beneficial in army horses, and has been advocated for routine use in farmers and workers in hazardous industries as well as in soldiers. One cubic centimeter of the toxoid injected subcutaneously produces no discernible antibody response, but when followed in eight to twelve weeks with at least one more such injection there ensues a solid protection for two months to a year. Even after the immunity has worn off, subsequent administration of the toxoid results in a rapid rise of the titer, and Dr. Firor advocated such injections every three months for those constantly exposed to tetanus infection. The blood level was found to reach 5 to 15 units of antitoxin per cubic centimeter. No reactions were encountered except for

slight local soreness, and there were no failures with the three-injection method.

The discussion was opened by Dr. LeRoy Fothergill, who explained the difference in reactions following toxoid vaccinations against tetanus and diphtheria. He stated that the latter is really due to sensitivity to the bacillary protein following repeated subclinical exposures to the diphtheria bacillus, a factor which is lacking in respect to tetanus. Although the lack of a sensitivity test comparable to the Schick test was noted, Dr. Fothergill stated that this was not a serious drawback, for a properly carried out inoculation results in practically 100 per cent "takes."

Dr. Fothergill could find no a priori basis for expecting that the intrathecal use of antitoxin should be better than the intravenous. He asserted that it is more difficult to reach the anterior horn cells through the vascular meninges than via the blood stream; furthermore, there is a local irritation of the already sensitive spinal cord. It was hypothecated, however, that such an irritation might increase the permeability of the blood-brain barrier and thus prove effective. Dr. Firor agreed with this theory.

NOTICES

ANNOUNCEMENT

EDWARD H. HOMMEL, M.D., announces the removal of his office from 515 East Broadway, South Boston, to 186 Dorchester Street, South Boston.

FELLOWSHIPS IN CHILD PSYCHIATRY

A limited number of fellowships have been provided by the Commonwealth Fund and by other sources for training in extramural, especially child, psychiatry. These fellowships are to be administered by the National Committee for Mental Hygiene, through which fellows are to be assigned for one or two years to a selected child-guidance clinic, the term and plan of the fellowship to be determined by the peculiar needs of the fellows. Candidates should have had at least two years of psychiatry in an approved mental hospital, in addition to other qualities fitting them for extramural service. These fellowships come in response to a definite paucity of personnel in this field. Accordingly, conditions as to age, sex, marital status and so forth must be governed by individual cases and by the nature of current demand. Requests for further information about these fellowships, and application therefor, should be addressed to Dr. Milton E. Kirkpatrick, National Committee for Mental Hygiene, Room 822, 50 West 50th Street, New York City.

SOCIETY MEETINGS AND CONFERENCES

SEPTEMBER 2–6 — American Congress of Physical Therapy. Page 862, issue of May 16.

OCTOBER 8–11 — American Public Health Association. Page 655, issue of April 11.

OCTOBER 11, 12 — Pan-American Congress of Ophthalmology. Page 898, issue of May 23.

OCTOBER 14–25 — 1940 Graduate Fortnight of the New York Academy of Medicine. Page 938, issue of May 30.

OCTOBER 21 — American Board of Internal Medicine. Page 369, issue of February 29.

JANUARY 4, 1941 — American Board of Obstetrics and Gynecology. Page 1064, issue of June 20.

APRIL 21–25, 1941 — American College of Physicians. Page 1064, issue of June 20.

DISTRICT MEDICAL SOCIETY

MIDDLESEX NORTH

JULY 31.

OCTOBER 30.

BOOKS RECEIVED FOR REVIEW

The Conservation of Intelligence. Theodore R. Robie. 25 pp. Montclair, New Jersey: privately published, 1940.

Sex in Marriage. Ernest R. Groves and Gladys H. Groves. 250 pp. New York: Emerson Books, Inc., 1940. $2.00.

Psychological and Neurological Definitions and the Unconscious. Samuel Kahn. 219 pp. Boston: Meador Publishing Co., 1940. $2.00.

The March of Medicine. Edited by the Committee on Lectures to the Laity of the New York Academy of Medicine. 168 pp. New York: Columbia University Press, 1940. $2.00.

Social and Biological Aspects of Mental Disease. Benjamin Malzberg. 360 pp. Utica, New York: State Hospitals Press, 1940. $2.50.

Principles of Surgical Care: Shock and other problems. Alfred Blalock. 325 pp. St. Louis: C. V. Mosby Co., 1940. $4.50.

A Manual of Neurohistologic Technique. Oscar A. Turner. 73 pp. St. Louis: C. V. Mosby Co., 1940. $2.00.

Principles of Hematology. Russell L. Haden. Second edition. 362 pp. Philadelphia: Lea & Febiger, 1940. $4.50.

Studies from the Rockefeller Institute for Medical Research. Vol. 115. 622 pp. New York: The Rockefeller Institute for Medical Research, 1940. $2.00.

The Era Key to the USP XI & NF VI. Revised by Lyman D. Fonda. Fifth edition. 320 pp. Newark: Haynes & George Co., Inc., 1939. $1.00.

The Diagnosis and Treatment of Pulmonary Tuberculosis. John B. Hawes, 2d, and Moses J. Stone. Second edition. 260 pp. Philadelphia: Lea & Febiger, 1940. $2.75.

An Introduction to Biochemistry. William R. Fearon. Second edition. 475 pp. St. Louis: C. V. Mosby Co., 1940. $3.75.

BOOK REVIEWS

Ptoses gastriques et coliques: doctrine — clinique thérapeutiques. M. Chiray and P. Chêne. 270 pp. Paris: Masson et Cie, 1939. 75 Fr. fr.

The authors begin by deploring the frequency and carelessness with which the diagnoses of ptosis of the stomach and colon are made, since this diagnosis predicates a long and rather rigorous therapeutic regime. Nevertheless, their own criteria for making the diagnosis may be open to criticism. The monograph on the whole is a rather verbose discussion of the various aspects of this subject which, although taken up systematically, offers very little that is new or enlightening. Some of the case histories presented make the treatise easy to read. The volume should be of interest to gastroenterologists as indicating the point of view which their authoritative French confreres have on this subject.

Diagnosis and Management of Diseases of the Biliary Tract. R. Franklin Carter, Carl H. Greene and John R. Twiss. 432 pp. Philadelphia: Lea & Febiger, 1939. $6.50.

The authors present a large mass of data in support of their hypothesis that the gall bladder and biliary tract are the sources of many gastrointestinal symptoms of vague nature, even though the gall bladder is not grossly or obviously diseased. They describe the gall bladder and the biliary tract, in various states of "biliary dyskinesia," as producing many of the common symptoms of functional

digestive disease and advocate the treatment of such symptoms by bland low-residue diets, either rich or low in fats, by antispasmodics and sedatives, by attention to bowel habits and by repeated therapeutic duodenal drainage.

There can be no argument with that part of the authors' work dealing with physiology and the application of diagnostic methods. The section on surgery covers well the present-day thought on surgical practice in diseases of the gall bladder and biliary tract.

On the other hand, there can be and is a vigorous school opposed to the principal thesis of the book, namely the treatment of so-called non-calculous cholecystitis or "biliary dyskinesia." Many of the conditions which they ascribe to the biliary tract could, with equal justice, be ascribed to other parts of the digestive apparatus and could be treated with equal effectiveness by ignoring the liver and its appendages and concentrating on the presenting symptoms and the more obvious functional disturbances of the gastrointestinal tract as a whole.

The authors believe in prescribing low-cholesterol diets, and report a lowering of the blood-cholesterol level and symptomatic improvement on such diets. As attractive as this theory may be, the reviewer is of the opinion that there is no good reason to believe that the lowering of the blood-cholesterol level should improve gall-bladder function. Low cholesterol diets are in the main low-fat diets, the latter having been used for years in the management of chronic gall-bladder disease. If cholesterol can be absorbed from the gall-bladder wall or from precipitated cholesterol in the gall bladder, a more likely approach would appear to consist of stimulation of bile flow by cholagogues or high-fat diets.

A Symposium on the Blood and Blood-Forming Organs. By fifteen authors. 264 pp. Madison, Wisconsin: University of Wisconsin Press, 1939. $3.50.

This volume deals with most of the material presented at the Institute for the Consideration of the Blood and Blood-Forming Organs, held at the University of Wisconsin Medical School on September 4, 5 and 6, 1939. The institute, which lasted three days, was a brilliant success, both in the size, type and enthusiasm of the audience and in the quality of the subjects presented. Minutiae of hematological morphology, so commonly discussed at similar European conferences, were for the most part set aside for considerations of the physiological concepts of disease.

The volume is highly recommended to the many physicians who have more than a passing interest in hematology. A charming discussion by Meulengracht on the history of hematology is followed by an erudite and important article on the porphyrins by Watson. Watson's style is a bit formidable but the article is worth digging through. Rhoads presents his comprehensive studies on what he chooses to call "aplastic anemia" or "refractory anemia." Many diverse conditions are indiscriminately grouped in this category, but one must credit the writer with the brilliance of his concepts and his ability to find "least common denominators" for apparently diverse conditions. Heath gives a synopsis of his work on anemia due to iron deficiency. Minot presents an abstract of his ideas on the anemias of nutritional deficiency, and Diamond gives a didactic discussion of the erythroblastic anemias. Then follow brilliant papers by Meulengracht on "Some Etiological Factors in Pernicious Anemia" and by Haden on "The Nature of Hemolytic Anemia." The latter is a comprehensive article discussing thoroughly the question of the spherocyte and the fragility test. Furth gives an excellent presentation of experimental leukemia with its human correlations, and Forkner has a well-documented article on monocytic leukemia. In his article on Hodgkin's disease, Krumbhaar presents some new work utilizing tissue-culture technic; if confirmed, this preliminary investigation would seem to indicate an infectious rather than a malignant basis for the condition. Doan has a very stimulating article on the reticuloendothelial system, in which are discussed such apparently unrelated subjects as hemolytic anemia, thrombocytopenic purpura, "primary splenic granulocytopenia" and monocytic leukemia; the spleen is said to be the center for these diverse conditions. Downey has a good morphological discussion of infectious mononucleosis, and the subjects of polycythemia and of marrow cultures are discussed by Reznikoff and Osgood respectively. Eagle's presentation of the "Blood Coagulation Problem" is excellently done and contains an extensive bibliography.

All in all, the volume is well worth owning, giving as it does much of the present-day work in the numerous fields of hematology. This first American Institute of Hematology indicates the greatly increased interest in the subject in this country and may well be the prelude to other equally successful gatherings in this field.

Bacteriology. Clio Medica 22. William W. Ford. 207 pp. New York and London: Paul B. Hoeber, Inc., 1939. $2.50.

This small book, which comes to join the excellent *Clio Medica* series on medical history, sets forth in a succinct but capable and interesting manner the significant theories and discoveries whereon modern bacteriology rests. In accord with the purpose of this series, which is to make available primers or straightforward statements of the important historical facts in each subject, the author of the present volume confines himself largely to outlining those fruitful investigations which have given impetus from time to time to broad advances in knowledge.

Thus we find recounted the development of optical science, which like so many others expanded rapidly in the congenial atmosphere of the late Renaissance. Here the contributions of Anton van Leeuwenhoek to the perfecting of simple lenses and Galileo's invention of the compound microscope are emphasized. Although such improvements in magnification as early as 1683 enabled Leeuwenhoek to see and describe bacteria so clearly that no doubt can exist concerning the accuracy of his observations, scientists of the eighteenth century surprisingly failed to take advantage of this momentous discovery. Their most notable offering, perhaps, is to be found in the experimentation of Spallanzani, which should have ended the impeding controversy over spontaneous generation. Jenner's magnificent experiments, not reported until the very end of the century, and never to be too often called to mind, are possibly given inadequate treatment in view not only of their great practical value but because of the immunological principles which they illuminate so brilliantly.

The remainder of the book is largely occupied with the work of the great masters, Pasteur and Robert Koch, and with the immediate harvest of new knowledge to which this gave rise. The story is, of course, familiar to all bacteriologists, but Professor Ford has told it well, and it is of value to have here readily available. A final chapter on later developments reviews most of the important conceptions in both bacteriology and immunology established by the researches of the first quarter of the present century.

Not the least pleasing feature of the book is the rather extensive and well-arranged bibliography.

Housing Yearbook 1939. Edited by Coleman Woodbury. 240 pp. Chicago: National Association of Housing Officials, 1939. $3.00.

Poor housing, disease and poverty are an anti-social triumvirate that have always moved together. As physicians have become more socially aware of the interrelatedness of social phenomena they have also become more concerned with doing what they can, both as citizens and as physicians, to break up this alliance.

This useful volume describes the federal, state and local activities in housing and reviews the work of the Federal Housing Administration and of the Home Owners Loan Board, and the housing activities of the Farm Security Administration. It concludes with a directory of housing agencies.

There are four very illuminating chapters written by Nathan Straus, Stewart McDonald, J. H. Fahey and W. W. Alexander.

It is impossible, in a brief review, to give the reader any conception of the range of useful facts to be found in this little volume. Here are a few, selected at random, on the Home Owners Loan Corporation (HOLC). In the low of the depression there were a thousand foreclosures a day. The HOLC took over mortgages totaling $932,000,000 from banks and trust companies, $767,000,000 from savings and loan associations, $192,000,000 from financing and mortgage companies and $164,000,000 from insurance companies. Thus the HOLC assisted these institutions in remaining liquid. This permitted the institutions to grant leniency to other distressed home owners and to lend to needy borrowers. The HOLC paid $229,000,000 to wipe out delinquent taxes and saved home owners $175,000,000 in interest by virtue of the Government's greater borrowing power. Of course, the HOLC has had to foreclose on some properties. But in nearly 90 per cent of such cases the "owners" were more than a year in arrears on principal and interest payments; in 63 per cent, the period was more than a year and a half. Twenty per cent of the foreclosures were voluntary, an estimated 18 per cent of the foreclosed properties being either abandoned or virtually so. J. H. Fahey, chairman of the board, recommends that the HOLC, rather than expending its revenues on hopeless cases, should now aid only those who have a real possibility in saving their homes, "so that the corporation may wind up its operations without great loss to taxpayers."

The other articles are similarly crammed with fascinating facts on housing, which are of substantial value to all students of these problems. The articles make clear to doubters that our housing problem is in the hands of able, conscientious administrators — all of which should give us confidence for the future.

Fractures. Paul B. Magnuson. Third edition. 511 pp. Philadelphia, Montreal and London: J. B. Lippincott Co., 1939. $5.00.

The author explains that the purpose in writing this text was "to meet the needs of the man who first sees the fracture," which limits the scope of the book to a more or less elementary discussion. Such a viewpoint has its advantages and disadvantages, both of which become apparent. The groundwork is well presented. Anatomical descriptions are worked out to explain the mechanical distortion which follows loss of skeletal support at various locations. The discussions of treatment are clear, outlining varieties of methods in general use. There is a wealth of clinical suggestion, warning the practitioner of complications which may be anticipated and suggesting methods to escape them. Descriptions of operative technic avoid minute details and are limited to the basic principles.

On the other hand, fracture treatment is advancing so rapidly that even a general text should include an ampler discussion of progressive methods than is here afforded. Intracapsular fractures of the neck of the femur, for example, are discussed so indecisively that one turns back to the title page to see if it is actually 1939 and not 1929. More space is given to the Whitman spica method than to Smith-Petersen's or Moore's nailing. We search in vain for reference to walking irons on casts or to skeletal traction for fracture-dislocations of the cervical vertebrae. Not a word of mention is given to the principles of double-pin fixation, advocated by Anderson. Neither drilling nor nailing of slipped, upper femoral epiphyses is suggested as a possibility, the old-fashioned clavicular cross being the only method mentioned for this common fracture. Such omissions detract from the value of a text of this sort.

Manual of Urology. R. M. LeComte. Second edition. 295 pp. Baltimore: The Williams & Wilkins Co., 1939. $4.00.

In this book the author has succeeded in presenting a remarkably concise and well-balanced treatise on diseases and disorders of the genitourinary organs. No condition of importance has been omitted, and the opinions expressed by him are representative of those which are commonly held by urologists. Although these opinions are stated emphatically and somewhat didactically, the author has departed from this attitude when commenting on subjects which are not yet clearly understood.

The reviewer noted only two statements with which he would not agree. On page 262, in the paragraph on treatment of testicular tumors, the author writes: "In cases with inoperable metastases, deep x-ray therapy may afford striking relief over long periods of time." The reviewer believes that the value of deep x-ray therapy as a preventive of the development of such metastases has been fully established. On page 263, it is stated that simple puncture of a hydrocele "is fraught with the dangers of hemorrhage and infection." In the reviewer's experience, these complications occur but rarely.

Aside from these two criticisms, the reviewer has nothing but praise for this manual and believes it will prove a valuable reference book for those who wish to acquire a general idea of genitourinary diseases.

Maternal Care and Some Complications: The principles of antepartum, intrapartum, and postpartum care and of the management of some serious complications. Edited by F. L. Adair. 194 pp. Chicago: University of Chicago Press, 1939. $1.50.

The first section of this little book is on maternal care, and it is a very clear, concise exposition of the care that any woman who is pregnant should receive from her physician. The second section takes up a few of the more common complications of pregnancy, the toxemias, obstetric hemorrhages and puerperal infection.

If this book were placed in the hands of every practitioner of medicine who is doing obstetrics, and if he would honestly and conscientiously follow out the suggestions and technic so carefully outlined, there is no question that a great improvement in obstetrics as practiced in this country would follow.

Psychobiology and Psychiatry: A textbook of normal and abnormal human behavior. Wendell Muncie. 739 pp. St. Louis: C. V. Mosby Co., 1939. $8.00.

This book, containing a foreword by Adolf Meyer, represents, as is stated in the preface, an attempt to put before students the concepts, teaching and working methods of the Henry Phipps Psychiatric Clinic of the Johns Hopkins Hospital. The important role which this clinic has played in psychiatric thought in America and abroad is too well known for comment. A textbook that presents the teaching methods of the clinic will be viewed with interest by all psychiatrists.

The book is composed of four parts. Part one deals with the study of normal behavior — the "material" of Adolf Meyer's ergasiology. After a brief historical account, and a presentation of what the author recognizes as the philosophical bases of psychobiology, ninety-three pages are devoted to an elaboration of Meyer's familiar students' personality study. Part two deals with abnormal behavior — the reaction types, or pathergasias, of the Meyerian school of psychiatry. Part three, consisting of seventy-seven pages, is allotted to treatment. Part four is a tabulated survey of the development of the concepts underlying clinical states which the author designates as reaction sets. This section is poorly arranged. Many of its one hundred and eighty-six pages are unnecessarily blank. For example, the part concerned with parergasia (schizophrenia) might well have included references to Clouston's "dementia of adolescence" and to Carl Wernicke's "sejunction" — a forerunner of Bleuler's schizophrenia concept.

It is the reviewer's opinion that the book is not a complete textbook of psychiatry to be compared with that of Henderson and Gillespie. It is a book which, as has been stated, presents the conceptions, teaching and working methods of the Henry Phipps Psychiatric Clinic — as they have developed under the guidance of Adolf Meyer.

Physiotherapy in Medical Practice. Hugh Morris. 276 pp. Baltimore: The Williams & Wilkins Co., 1939. $4.50.

"This book is not intended for the specialist but for the practitioner who wants to know what he can expect from electrotherapy and who prefers to prescribe the treatment to be given to his patients instead of leaving the choice to a masseuse, as is so often done." This quotation from the preface not only designates the group of physicians for whom the book was written but also implies a just criticism of the others who stoop to the technician not only for the technical application of physical therapy but even for the medical judgment to be exercised in choosing a given physical agency or modality.

In relatively few pages the author has managed to do justice to the physics, physiological effects, indications and technic of application of the various measures commonly employed by the average physical therapist. This was made possible by the author's knowledge of the underlying principles of the subject matter which he covers and by his economical style of writing.

Certain minor improvements can be suggested. His explanation of induction is altogether too brief and somewhat involved, considering that it represents the most important method of generating electricity, the latter being the backbone of the entire treatise. To the faradic coil, which forms an important part in the testing of paralysis, he has allocated only five lines, while a page is devoted to the dynamo-and-motor current. In discussing the static machine he speaks of the principle of induction but makes no reference to that of friction, notwithstanding the fact that the latter gives the initial charge. Again, poor judgment has been used in the allocation of pages. The static machine is used very little as compared with short-wave apparatus, yet the consideration of the former takes up ten pages whereas that of the latter is given only seven. However, these shortcomings are of minor importance as compared with the advantages that this book has over other texts of similar nature. It is brief, yet covers the ground well and fulfills the aim of its author, namely, to supply the general practitioner with the necessary knowledge of principles, skill of application and sound judgment to be exercised when prescribing and applying the various measures of physical therapy.

Modern Clinical Psychiatry. Arthur P. Noyes. Second edition. 570 pp. Philadelphia and London: W. B. Saunders Co., 1939. $5.00.

No book deserves the word "modern" in its title more than this, because it rejects *en masse* the accumulated learning of a generation or two of scientists and presents a current point of view exclusively even though temperately. The long line of doctors who insisted that persons with mental disease were sick and should have medical care are disposed of forthwith. For instance on page 89 it is stated: "The minor and many of the major psychoses should not be considered as 'diseases' in the usual sense of the term but as an individual's unwholesome, poorly adjusted methods of reaction to his particular stresses and problems. . . . What we call mental disease is therefore not a disease entity but an individual problem in human behaviour, a problem in personality maladjustment." All will, of course, agree with the statement (page 95), "Mind is an integral function of the organism and cannot be split up into components"; but shall we also accept the taboo, "We must therefore not think of it as a sort of machine different parts of which sense, perceive, imagine, remember, associate, reason about, desire, choose, etc."? Krepelin is not included in the bibliography at the end of the chapter, "Symptoms of Mental Disease"; in fact, the old gods are fairly well dethroned. The new ones are accepted with the zeal of a missionary. There is even a paragraph on psychogenesis in the description of paresis.

This is a good book, well written and showing much erudition. It perhaps expresses the high tide of the psychological approach to mental disease, certainly advancing medical knowledge in no other way.

An Introduction to Genetics. A. H. Sturtevant and G. W. Beadle. 391 pp. Philadelphia and London: W. B. Saunders Co., 1939. $3.25.

The authors treat the subject of genetics as a "mathematically formulated subject that is logically complete and self-contained." Readers should be familiar with elementary biology and have an understanding of the simple laws of probability to appreciate the handling and interpretation of the genetic data contained in this book. The reviewer believes that the material is presented in a noteworthy, concise manner wholly consistent with the effort to teach students the fact that genetics is largely a science of ratios. At the end of each chapter the authors give problems well calculated to arouse interest and enthusiasm on the part of students. There are many good diagrams and figures.